

U.S. Army Center for Health Promotion  
and Preventive Medicine

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**TRAINING MUNITIONS HEALTH RISK  
ASSESSMENT  
NO. 39-EJ-1485-00  
RESIDENTIAL EXPOSURE FROM INHALATION OF  
AIR EMISSIONS FROM THE 155-MM PROPELLING  
CHARGE (M3 SERIES)  
DEPARTMENT OF DEFENSE IDENTIFICATION CODE: D540**

Prepared by:

Environmental Health Risk Assessment Program

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## *U.S. Army Center for Health Promotion and Preventive Medicine*

*The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.*

*Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.*

*On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.*

*The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:*

★ *Integrity is the foundation*

★ *Excellence is the standard*

★ *Customer satisfaction is the focus*

★ *Its people are the most valued resource*

★ *Continuous quality improvement is the pathway*

*This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.*



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14. ABSTRACT This assessment evaluated the potential for human health effects to offsite residents breathing air emissions following use of the 155 mm Propelling Charge. This document present the evaluation of the potential for adverse human health effects to the offsite residents breathing air emissions following the use of military firing ranges during training exercises. Study results showed no potential for health risks to the hypothetical resident from inhalation of air emissions from the 155 mm propelling charge. To conduct this study, air emissions from the 155mm charge were collected in a test chamber ( at Aberdeen Test Center, Aberdeen, MD). This information was then used in an air dispersion model to determine ambient air concentrations at a location downwind from the site where the item was activated. Modeled air concentrations were combined with exposure information to estimate the amount of substances the hypothetical resident breathes. This intake was combined with the substance's health information, to determine if there is a potential for health risks from inhalation of these substances. The health risk included both long-term and short term exposures to the modeled substance concentrations. Study results showed no potential for helath risks from inhalation of air emissions from the 155mm propelling charge (M3 Series)					
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TRAINING MUNITIONS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-00  
RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS  
FROM THE 155-MM PROPELLING CHARGE, M3 SERIES

### EXECUTIVE SUMMARY

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This assessment evaluated the potential for human health effects to offsite residents breathing the air emissions from the 155-mm propelling charge used during training exercises. Propelling charges are used in weapons to provide the force needed to send a projectile to its target. This assessment looked at five different combinations in which the 155-mm propelling charge is used. This involved looking at the two 155-mm propelling charges, M3 and M3A1, fired from the M199 and M284 howitzer cannons, and for two different charge zones.

To conduct this assessment, air emissions from the 155-mm propelling charge were collected in a test chamber located at the U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, Maryland. The data collected from the Firing Point Emission Study provided the amount and types of substances released from the 155-mm propelling charge. This information was then used in an air dispersion model to determine ambient air concentrations at locations downwind from the 155-mm propelling charge firing location. Since the training facility in this assessment is hypothetical, the air model used assumptions that provided conservative estimates of air concentrations.

Modeled air concentrations were combined with exposure information (e.g., number of exposures per year) to estimate the amount of each substance the hypothetical resident breathes. This estimate was combined with a substance's health information, which was obtained from agencies such as the U.S. Environmental Protection Agency, to determine if there is a potential for health risks from inhalation.

The health risk assessment included both long-term (30 years) and short-term (15 minutes or 1-hour) exposures to modeled substance concentrations. Assessment results, generated using conservative methods, showed that the hypothetical offsite resident breathing air as close as 200 meters (656 feet) from the M3 and M3A1 firing locations is safe from these emissions. It should be noted that at most training facilities, training areas are at least 1,000 meters (over half a mile) away from populated areas.

*Readiness thru Health*

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## LIST OF ACRONYMS

AEGL	Acute Exposure Guideline Levels
AIHA	American Industrial Hygiene Association
Cr	Chromium
DODIC	Department of Defense Identification Code
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guidelines
HBSL	Health-Based Screening Level
HCl	Hydrochloric Acid (or Hydrogen Chloride)
INPUFF	Integrated Puff Model
mg	Milligram
mm	Millimeter
NAAQS	National Ambient Air Quality Standards
NAC/AEGL	National Advisory Committee for Acute Exposure Guideline Levels
NEW	Net Explosive Weight
NH <sub>3</sub>	Ammonia
OEL	Occupational Exposure Limit
PM <sub>10</sub>	Particulate Matter Under 10 Microns in Size
PRG	Preliminary Remediation Goals
RBC	Risk-Based Concentration
RfC	Reference Concentration
TEEL	Temporary Emergency Exposure Limits
TPCWG	Total Petroleum Criteria Working Group
TSP	Total Suspended Particulates
USAATC	U.S. Army Aberdeen Test Center
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEC	U.S. Army Environmental Center

## TRAINING MUNITIONS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-00 RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS FROM THE 155-MM PROPELLING CHARGE (M3 SERIES)

### 1. PURPOSE

This document presents the assessment of the potential for human health effects to offsite residents who may be exposed to air emissions following the use of the 155-mm propelling charges, M3 and M3A1.

### 2. AUTHORITY

Memorandum, U.S. Army Environmental Center, 4 June 1999, Subject: Pyrotechnics Risk Assessment.

### 3. REFERENCES

See Appendix A for a list of references.

### 4. BACKGROUND

#### 4.1 WHAT ARE PROPELLING CHARGES?

Propelling charges (or propellants) are a type of explosive used in weapons to send a projectile to the target. When ignited, the propelling charge causes the pressure inside the weapon to build up quickly. This pressure eventually reaches a maximum and pushes the projectile out of the barrel to the target. Some examples of projectiles include rockets, bullets, and missiles.

The amount of propelling charge used varies with the type of weapon. In smaller arms (typically any gun below a 20-mm bore size), the propelling charge is fixed. In larger weapons such as artillery ammunition, the propelling charge may be adjustable. These kinds of ammunition are also called semi-fixed ammunition. For semi-fixed ammunition, the propellant is divided into different charges. The amount of propellant used in semi-fixed ammunition depends on various factors such as distance to the target.

Propelling charges are also used to send fireworks into the sky or in flares to send the signal into the air. The major difference between these various devices is the composition of the propellant and the amount of propellant used.

#### 4.2 WHAT IS THE 155-MM PROPELLING CHARGE?

The 155-mm propelling charge is used for firing projectiles from 155-mm howitzers (a kind of cannon). It is a semi-fixed ammunition propellant that is issued in five bags of different charges. Each bag is also called an increment and contains a premeasured amount of propellant. The bags are fastened together with cloth straps

sewn to the base of each increment and tied on the top of the fifth increment (Reference 1). The 155-mm propelling charge can be classified into two types: M3A1 and M3 (M3 series). They are also commonly called "green bags" because the charges are loaded in green cloth bags.

The M3 series contain about 5.5 pounds of propellant. Charge M3A1 also includes flash reducer pads that contain either potassium nitrate or potassium sulfate. As the name suggests, the reducer pads are used to limit breech flareback, muzzle flash, and blast overpressure in the weapon. Both the M3A1 and the M3 charges are issued with an igniter charge that is made up mostly of nitrocellulose or black powder, respectively. Both nitrocellulose and black powder are commonly used in consumer fireworks.

#### 4.3 USES OF THE 155-MM PROPELLING CHARGE

Up to five charges can be loaded into the howitzer before a projectile can be fired. The base charge is always used and subsequent increments are loaded depending on the type of projectile or cannon used, or the distance to the target. The amount of propellant used defines a particular charge zone. For example, charge zone 3 means that the base charge and charge increments 2 and 3 are used. The range of each charge zone will vary for different weapon and projectile types.

It is very important for our troops to learn and understand the proper use of the different types of propellants and projectiles. Only through training can they learn to safely and efficiently use these devices to prepare them for combat situations.

#### 4.4 ASSESSMENT SUMMARY

The general assessment approach consisted of two main parts: air dispersion modeling and exposure assessment. These are briefly discussed in the paragraphs below. Sections 5 through 7 present a discussion of the methodology used for this assessment.

Emissions data used in the air dispersion modeling was obtained from the Firing Point Emission Study, conducted by the U.S. Army Aberdeen Test Center (USAATC), at Aberdeen Proving Ground, Maryland (References 2, 3). This study was funded by the U.S. Army Environmental Center (USAEC) with the purpose of identifying and quantifying emissions from weapons firing. Data from this study was generated by firing munitions with weapons that are representative of those used by the U.S. Army during training operations.

The emissions data for the 155-mm propelling charge was used with an atmospheric dispersion model to estimate the average concentrations that may be experienced by an offsite resident. Since this assessment is designed to provide results that would be applicable to most Army training facilities, the training area used in this assessment was a hypothetical one. While most training areas are at least 1,000 meters away from populated areas, as a conservative distance, it was initially assumed



that a person could reside 100 meters downwind from the firing point (location where the cannon is positioned). In addition, air-modeling parameters were selected to mimic worst-case conditions.

The exposure assessment included calculations of time-averaged concentrations for both long-term (chronic) and short-term (acute) exposures. For the purpose of this assessment, air concentrations were averaged over 30 years for chronic exposures and 1-hour or 15 minutes for acute exposures. Using a screening approach, a substance's estimated time-averaged air concentration was then compared to chronic health-based screening levels (HBSLs) established by the U.S. Environmental Protection Agency (EPA) or acute toxicity values (ATVs) established by selected agencies depending on the exposure duration (i.e., 30 years versus 1-hour or 15 minutes). The comparison was made using the ratio of the HBSL or ATV to the estimated air concentration for each of the substances evaluated. If this ratio was less than one, no further evaluation was needed. This approach is conservative because the exposure assumptions used by the agencies, to establish HBSLs and ATVs, are likely to overestimate the exposures experienced by offsite residents living near firing ranges. If the chronic or acute averaged concentrations ( $C_{\text{chronic}}$  and  $C_{\text{acute}}$ ) were greater than the screening levels, producing a ratio greater than one, further evaluation would be warranted to determine the potential for health effects. Note that concentrations greater than the screening levels do not indicate an onset of health effects, but rather, the potential for such.

## 5. DATA COLLECTION AND AIR MODELING

### 5.1 EMISSION FACTORS

Emission factors, used to derive the air modeling emission rates used in this assessment, were generated from the Firing Point Emission Study conducted by USAATC. This study identified and quantified air emissions from the firing of training munitions. The data included the net explosive weight (NEW), the substances sampled, and substance-specific emission factors. The 155-mm propelling charge is the first in this series of testing that fall under the Firing Point Emission Study.

Tests for the 155-mm propelling charge were conducted using conditions that would typically be encountered during short-range training or test exercises. Both the M3A1 and the M3 charges were tested using different cannons. Table 1 summarizes the test conditions in which these charges were fired. The resulting emissions data from these tests are included in the first four columns of the air dispersion modeling output data in Appendix B.



**TABLE 1: TEST CONDITIONS FOR THE 155-MM PROPELLING CHARGES**

Test Munition	Weapon	Projectile	Charge Zone
Charge M3	M199 howitzer cannon	Inert M107 HE <sup>1</sup>	3
	M199 howitzer cannon	Inert M107 HE	5
	M248 howitzer cannon	Inert M109 HE	3
Charge M3A1	M199 howitzer cannon	Inert M109 HE	3
	M248 howitzer cannon	Inert M109 HE	3
<sup>1</sup> HE = high explosive Source: Reference 2			

## 5.2 BACKGROUND AND DESCRIPTION

Air dispersion models are available to mathematically simulate plume behavior and to estimate downwind concentrations of substances emitted from various sources. However, specific models are not available to determine the dispersion of emissions from munitions used during training. Estimating the magnitude and location of these concentrations depends on many factors including the amount and type of emissions, the behavior of the source, and meteorological conditions. Since a specific model is not available for modeling the use of munitions during training, the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) evaluated numerous air models to determine which would be suitable for use with munitions used during training. The USACHPPM recommended using the Integrated PUFF (INPUFF) model to estimate the dispersion of emissions from various sources (Reference 4).

The INPUFF Model (Reference 5) was developed to simulate dispersion from instantaneous or semi-continuous point sources. This Gaussian-integrated puff model is capable of addressing a cloud type release over short periods of time, and computations can be performed for a single point source for multiple receptors. The algorithms used to calculate concentrations assume a vertically uniform wind direction (with no chemical reaction) to compute the contribution of each cloud at a receptor for each time step/interval.

## 5.3 MODEL ASSUMPTIONS

Some assumptions were made to best represent the firing of 155-mm rounds with the M3 and M3A1 propellant charges. These assumptions were as follows:

- Typically, with conventional point sources (such as incinerators), the cloud rise and formation are determined by characterizing flue gas exit velocity, temperature, and stack diameter. However, the M3 and M3A1 propellants are used in conjunction with cannon systems of various lengths and diameters. For unconventional sources with no real physical stack dimensions, such as the 155-mm howitzer cannons, the stack height and

diameter were assumed to equal to the height of the barrel and the bore diameter. No exit velocity was used with these sources because the emission rates generated from the test data were obtained from sampling a stabilized cloud with no exit velocity. Table 2 includes the source parameters used to model the M3 and M3A1 propellant charges.

**TABLE 2: SOURCE PARAMETERS**

Parameter	Model Input
Source/Stack Diameter	0.155 meters
Source/Stack Height	1.52 meters
Source Exit Temperature	Varied per propellant combination tested
Exit Velocity	0 meters/second
Initial horizontal dispersion coefficient ( $\sigma_y$ )	Varied per propellant combination
Initial vertical dispersion coefficient ( $\sigma_z$ )	Varied per propellant combination

- The two cannons used for this study were the M199 and M284 howitzers. Initial cloud dimensions are preferred to model the air emissions from these types of releases. Since this information was not measured during the studies conducted at the USAATC, visual estimates of each cloud's two-dimensional length and height were made using video footage for each test condition. The video footage showed three distinct exhaust clouds that were produced from the firings. Both cannons are equipped with muzzle brakes that divert exhaust gases and pressures 90 degrees to the left and right and to the center (front) of the muzzle. All three clouds were combined to form a single worst-case cloud with an effective volume ( $V_e$ ) and effective radius ( $r_e$ ). The initial horizontal and vertical dispersion values ( $\sigma_y$  and  $\sigma_z$ ) of the single worst-case cloud were determined from the height and length of the single worst-case cloud. Temperature and pressure data were also recorded during testing. An average cloud temperature was calculated based on the temperatures recorded for each cloud produced during a firing scenario.

The volume of each cloud was calculated using Equation 1 and a sample calculation is provided in Example 1.

$$V = \pi r^2 h \quad \text{Equation 1}$$

Where:

$V$  = Volume ( $\text{ft}^3$ )

$r$  = radius; one half the height of the cloud (ft)

$h$  = length of the cloud (ft)

**Example 1**

**Sample Calculation Using Equation 1:**

$$V_{\text{left}} = \pi(1.5)^2(15) = 106.02 \text{ ft}^3$$

Calculation provided for clouds produced from the M3 propellant, Zone 3, using the M199 cannon. Based on visual estimates, the three clouds produced by this test condition were nearly equal in height and length.

The cumulative/effective volume of each cloud was calculated using Equation 2. Example 2 provides an sample calculation using Equation 2.

$$V_e = V_{\text{left cloud}} + V_{\text{right cloud}} + V_{\text{center cloud}}$$

Equation 2

Where:

$V_e$  = the effective volume of a single worst- case cloud ( $\text{ft}^3$ )

Note: The volumes of the left, right and center clouds were based on two-dimensional measurements of height and length. The clouds were assumed to grow equally in all directions.

**Example 2**

**Sample Calculation Using Equation 2:**

$$V_e = 106.02 + 106.02 + 106.02 = 318.06 \text{ ft}^3$$

Calculation provided for clouds produced from the M3 propellant, Zone 3, using the M199 cannon. Based on visual estimates, the three clouds produced by this test condition were nearly equal in height and length.

- The effective radius ( $r_e$ ) of the worst- case cloud was calculated using Equation 3. A sample calculation is provided in Example 3 below.

$$r_e = \sqrt{\frac{V_e}{\pi h}} \quad \text{Equation 3}$$

Where:

$V_e$  = the effective volume of a single worst- case cloud ( $\text{ft}^3$ )

$r_e$  = the effective radius of a single worst- case cloud (ft)

Note: Assuming a cylindrical cloud with the prevailing wind direction being perpendicular to the cannon muzzle when fired,  $r_e$  is equal to the initial vertical dispersion,  $\sigma_z$  and the initial horizontal dispersion,  $\sigma_y$  is equal to one half the length of the worst- case cloud.

**Example 3**  
**Sample Calculation Using Equation 3:**

$$r_e = \sqrt{\frac{318.06}{\pi(15)}} = 2.60 \text{ ft}$$

Calculation provided for clouds produced from the M3 propellant, Zone 3, using the M199 cannon.

- For this assessment, a hypothetical offsite resident was assumed to be located first at 100 meters, then at 200 meters directly downwind from the source. The meander of the cloud is a major factor when estimating concentrations at given locations downwind from the source. Assuming that the resident is directly downwind from the source is the same as assuming that there is no cloud meander and that the center of the cloud migrates directly over the hypothetical offsite resident. This assumption provides the most conservative modeled concentrations.
- Since this assessment does not look at a specific training site, generic, worst-case meteorological data were used. To determine the worst-case meteorological conditions that would result in the highest air emission concentrations, the modeling was performed using the EPA Risk Management Program Guidance (Reference 6). This guidance includes tables for estimating the footprint of chemical releases, and is intended to inform emergency responders of potential accidental releases. The EPA has

defined most default conditions for meteorological modeling parameters. Table 3 lists the meteorological parameters that were used in the air model.

**TABLE 3: WORST-CASE METEOROLOGICAL PARAMETERS**

Parameter	Model Input
Wind Speed	1 meter/second
Atmospheric Stability	Category F
Wind Direction	270°
Ambient Temperature	293 degrees Kelvin (°K) (or 68 °F)

#### 5.4 GENERAL METHODOLOGY

The model was run for a total calculation time of 200 seconds for the 100-meter location and 400 seconds for the 200-meter location. This was done to simulate a single round being fired and to ensure that the total mass of the cloud had passed the receptor locations. Concentrations were calculated every 2 or 4 seconds, depending on the location being modeled. Table 4 contains the air model input parameters used in this assessment.

**TABLE 4: AIR MODEL INPUT PARAMETERS**

Parameter	Model Input	
	100 meters	200 meters
Number of meteorological periods (NTIME)	1	
Duration of each meteorological period (ITIME)	200 seconds/400 seconds	
Number of updates to the source (NSRCDS)	100	
Duration/time step between each source update (ISUPDT)	2 seconds/4 seconds	
Total time modeled/Simulation Period (NTIME) (ITIME)= (NSRCDS) (ISUPDT)	200 seconds/400 seconds	

#### 5.5 USE OF MODEL OUTPUT

The concentrations provided by the INPUFF model were based on a unit emission rate of 1 gram/second from an emission source, and did not represent any substance-specific concentrations from the use of any weapons system. This unit emission rate is typically used for ease of modeling purposes. The relationship between the emission rate and predicted concentration is linear. Therefore, the ratio of the predicted concentration to the unit emission rate was multiplied by each substance-specific emission rate to provide substance-specific concentrations.

## 5.6 DETERMINATION OF SUBSTANCE-SPECIFIC EMISSION RATES

The actual emission rate for one item ( $ER_1$ ) for each substance was calculated using Equation 4. Example 4 contains a sample calculation using this equation.

$$ER_1 = \frac{EF \cdot CV}{t} \quad \text{Equation 4}$$

Where:

$ER_1$  = emission rate for one item (g/sec)  
 $EF$  = average adjusted emission factor (lb/item)  
 $CV$  = conversion factor (453.59 g/lb)  
 $t$  = release duration obtained from the INPUFF model (sec)

### Example 4 Sample Calculation Using Equation 4:

$$ER_1 = \frac{(4.120 \text{ E} - 02) (453.59)}{(4)} \times 1 \text{ item}$$

$$= 4.672 \text{ E} + 00 \text{ g/sec}$$

Calculation provided for ammonia ( $\text{NH}_3$ ) from data for the M3, Zone 3, M199 cannon, 200 meters downwind from the firing point. Appendix B contains the average adjusted emission factor of  $\text{NH}_3$  in lb/item.

Substance-specific ambient concentrations for one item ( $CONC$ ) were calculated using Equation 5. A sample calculation is provided in Example 5.

$$CONC = ER_1 \cdot \frac{UC}{ER_{unit}} \quad \text{Equation 5}$$

Where:

$CONC$  = substance concentration based on one item ( $\text{g/m}^3$ )  
 $ER_1$  = emission rate for one item (g/sec)  
 $ER_{unit}$  = unit emission rate as used in the model (g/sec)  
 $UC$  = concentration based on the unit emission rate ( $\text{g/m}^3$ )

**Example 5**  
**Sample Calculation Using Equation 5:**

$$CONC = (4.672E + 00) \frac{(6.914E - 05)}{(1)}$$

$$= 3.230E-04 \text{ g/m}^3$$

Calculation provided for NH<sub>3</sub>, for the propelling charge M3, Zone 3, M199 cannon, 200 meters downwind from the firing point.

## 6. RISK ASSESSMENT

### 6.1 EXPOSURE ASSUMPTIONS

Exposure assumptions were selected using a typical use scenario for the 155-mm propelling charge. This use scenario was provided by the USAEC and is based on consultation with their senior training advisor (References 7). The frequency of use of the propelling charge was required to determine how much substance an offsite resident would be exposed to in the time period of interest (i.e., acute or chronic exposure). Table 5 summarizes the general use scenario for the 155-mm propelling charge.

**TABLE 5: FREQUENCY OF USE FOR THE 155-MM PROPELLING CHARGE**

Parameter	General Training Scenario
Number of items used per training scenario	98 items over 6 weeks
Number of training scenarios per year at a specific training location	2
Time between events	Week 1 – 30 per 24 hour period Week 3 – 34 per 24 hour period Week 5 – 34 per 24 hour period
Maximum number of items that could potentially be used in one hour	26

### 6.2 TIME-AVERAGING

For the chronic assessment, time-averaged concentrations were calculated by assuming that the hypothetical resident would be exposed for 30 years. This is consistent with the exposure duration used by the EPA, which assumes that the resident spends 30 years at the same residence. By using the same exposure duration, the estimated time-averaged concentrations could be compared with their respective HBSLs, which are derived using standard EPA default assumptions.

As shown in Table 5, training in which the 155-mm propelling charge is used occurs over two 6-week periods (Reference 6). In addition, based on the information

provided, actual training takes place three times during this 6-week period. Therefore, for this assessment, the total number of days that a nearby resident was exposed to the air emissions from the 155-mm propelling charge is 6 days a year (3 days per training scenario x 2 trainings scenarios per year).

Another parameter that is needed for the exposure assessment is the duration of each exposure. This parameter depends on various factors such as wind velocity and therefore, cannot be accurately predicted. However, to be consistent with the assumptions used in the air model, the simulation period (see Table 4) for each round was used in the exposure assessment. This simulation period is the same for the five different test conditions.

The average daily concentrations were calculated using Equation 6. A sample calculation using  $\text{NH}_3$  is shown in Example 6.

$$C_d = \frac{\text{CONC} \cdot 10^6 \cdot ET_{\text{round}} \cdot EF_{\text{day}}}{1440} \quad \text{Equation 6}$$

Where:

$C_d$	= the average daily concentration ( $\mu\text{g}/\text{m}^3$ )
CONC	= average modeled concentration ( $\text{g}/\text{m}^3$ )
$10^6$	= units conversion ( $\mu\text{g}/\text{g}$ )
$ET_{\text{round}}$	= exposure time (minutes/round)
$EF_{\text{day}}$	= number of events per day (rounds/day)
1440	= unit conversion (minutes/day)

**Example 6**  
**Sample Calculation Using Equation 6:**

$$C_{d(\text{NH}_3)} = \frac{(3.231\text{E} - 04)(10^6)(6.67)(34)}{1440}$$

$$= 5.088\text{E}+01 \mu\text{g}/\text{m}^3$$

Example is provided for charge M3 (zone 3), using the M199 cannon. Averaged modeled concentration of  $\text{NH}_3$  is for a distance of 200 meters downwind from the firing point. Table 6 summarizes the exposure parameters.



Chronic averaged concentrations were calculated using Equation 7. The resulting concentration ( $C_d$ ) from Equation 6 was used in Equation 7 to determine the averaged chronic concentrations. Example 7 shows how this calculation was performed.

$$C_{chronic} = \frac{C_d \cdot EF_{years} \cdot ED}{AT} \quad \text{Equation 7}$$

Where:

$C_{chronic}$  = average chronic concentration ( $\mu\text{g}/\text{m}^3$ )  
 $C_d$  = average daily concentration ( $\mu\text{g}/\text{m}^3$ )  
 $EF_{years}$  = number of days per year (days/year)  
 $ED$  = exposure duration (year)  
 $AT$  = averaging time (days)  
 (for carcinogenic endpoint,  $AT = 70 \text{ years} \times 365 \text{ days per year}$ ;  
 noncarcinogenic endpoint,  $AT = ED \times 365 \text{ days per year}$ )

**Example 7**  
**Sample Calculation Using Equation 7:**

$$C_{chronic(NH_3)} = \frac{(5.088 \text{ E} + 01)(6)(30)}{(30)(365)}$$

$$= 8.36\text{E-}01 \mu\text{g}/\text{m}^3$$

Averaged daily concentration was calculated as shown in Example 6. Table 6 summarizes the exposure parameters.

This assessment assumed that the same person would be exposed 6 days every year for 30 years. As shown from Table 5, the use of the 98 items is spread out unevenly over a 6-week period. Therefore, to provide conservative estimates for this assessment, it was assumed that 34 rounds (as opposed to 30 rounds) were activated during each day of training. This results in a total of 104 items used over a 6-week period as opposed to the 98 items listed in Table 5. Table 6 summarizes the exposure parameters used in Equations 6 and 7.

**TABLE 6: EXPOSURE PARAMETERS USED TO DETERMINE TIME-AVERAGED CHRONIC AIR CONCENTRATIONS**

Exposure Parameter	Value Used
Exposure Time (ET <sub>round</sub> )	
At 100 meters	3.60 minutes/round
At 200 meters	6.67 minutes/round
Exposure Frequency (EF <sub>day</sub> )	34 rounds/day
Exposure Frequency (EF <sub>year</sub> )	6 days/year
Exposure duration (ED), years	30 years

Unlike the chronic assessment, only limited guidance for evaluating acute exposures is currently available. For the purpose of this assessment, acute is defined as a 1-hour or a 15-minute exposure. The 1-hour or 15-minute acute exposure averaging times allow for comparison with guidelines developed specifically for emergency planning purposes (see discussion on acute toxicity below).

The USAEC senior training advisor conservatively estimated that as many as 26 rounds could be fired in 1 hour. Based on the lack of information to better quantify acute exposures, this assessment assumed that 26 rounds are used in one hour. Average acute concentrations were computed using Equation 8 followed by a sample calculation in Example 8. If a substance has an acute toxicity that is based on a 15-minute exposure, Equation 8 was adjusted by a factor of 1/0.25 (where 0.25 is 15 minutes expressed in hours).

$$C_{acute} = \frac{CONC \cdot 10^6 \cdot ET_{round} \cdot EF_{hour}}{60} \quad \text{Equation 8}$$

Where:

$C_{acute}$  = average acute concentration ( $\mu\text{g}/\text{m}^3$ )  
 $CONC$  = average modeled concentration ( $\text{g}/\text{m}^3$ )  
 $10^6$  = unit conversion ( $\mu\text{g}/\text{g}$ )  
 $ET_{round}$  = exposure time (minutes/round)  
 $EF_{hour}$  = exposure frequency (rounds/hour)  
 $60$  = units conversion, (minutes/hour)

**Example 8**  
**Sample Calculation Using Equation 8:**

$$C_{acute(NH_3)} = \frac{(3.231E-04)(10^6)(6.67)(26)}{60}$$
$$= 9.33E+02 \mu\text{g}/\text{m}^3$$

Example is provided for charge M3 (zone 3), using the M199 cannon. Averaged modeled concentration of  $\text{NH}_3$  is for a distance of 200 meters downwind from the point source. Since the acute toxicity value for  $\text{NH}_3$  is based on a 1-hour exposure, no further adjustment in the acute concentration was necessary.

### 6.3 TOXICITY ASSESSMENT

The potential for health risks was determined by comparing time-averaged air concentrations to health-based screening levels, which are developed from a substance's known toxicity. These toxicity values typically include different levels of safety factors depending on the level of confidence of the critical study. Appendix C contains a table of screening toxicity values for the chronic and the acute assessments.

#### 6.3.1 CHRONIC ASSESSMENT

The chronic assessment was conducted using a screening approach. Using this method, a substance's estimated time-averaged concentration was compared to its HBSL by using the ratio of the HBSL to the estimated concentration. If this ratio was less than one, no further analysis was necessary. This approach is conservative because the exposure assumptions used by the EPA, to develop HBSLs, assume that the resident is exposed for 350 days per year (this assumes 2 weeks of vacation per year). In contrast, exposure to air emissions from actual training with the 155-mm propelling charge is intermittent and not likely to occur on a daily basis year round.

A hierarchy of sources was developed for selection of the HBSLs to quantitatively evaluate as many of the identified substances as possible. The hierarchy of sources used was as follows:

- Clean Air Act, EPA National Ambient Air Quality Standards (NAAQS) (Reference 11)
- EPA Region 9 Preliminary Remediation Goals (PRGs) (Reference 9)
- EPA Region 3 Risk-Based Concentrations (RBCs) (Reference 8)

Some substances have neither PRGs nor RBCs because they have their own set of regulatory standards. Under the Clean Air Act, the EPA is required to establish NAAQS for several substances considered harmful to public health and the

environment. Currently, NAAQS are available for seven substances. The NAAQS for the longer averaging time were used for the chronic assessment. Depending on the substance, this can range from an 8-hour average to an annual average. In addition, since the majority of the measured total suspended particulates (TSP) were PM<sub>10</sub> (particulate matter under 10 microns in size) (Reference 3), the NAAQS for PM<sub>10</sub> was used to evaluate the potential for health effects from exposure to TSP.

Next on the hierarchy, after the NAAQS, are the EPA Region 9 PRGs and the EPA Region 3 RBCs. Since the methodology used by EPA Region 9 to develop the PRGs generally results in lower values than the EPA Region 3 RBCs, the PRGs were first on the hierarchy of sources. RBCs were used when a PRG was not available. The only exception was for chromium (VI) [Cr (VI)] where Region 9 used a carcinogenic toxicity value that was seven times greater than EPA's recommended value (Reference 10) to develop its screening level for inhalation exposure. Since the EPA does not advocate the application of this multiplication factor, the RBC for Cr (VI) was used instead of the PRG. To ensure that the most recent information was used, the Internet sites of both EPA Regions were checked. The HBSLs used for this assessment are presented in Appendix C.

Although the general approach used by both EPA Region 3 and Region 9 is the same, the exposure assumptions differ enough so that final recommended values can vary to a certain degree. In both methods, a substance's screening concentration was selected using the toxicity endpoint that derives a lower concentration. For example, if a substance has a known systemic toxicity and is a carcinogen, the screening concentration was calculated using both toxicity values. To maintain a conservative approach, EPA then selected the lower screening concentration as the recommended PRG or RBC.

Example 9 shows a sample calculation of how a substance's estimated chronic concentration is compared to its HBSL.

**Example 9**

**Sample Calculation Comparing a Substance's Estimated Chronic Concentration to Its Health-Based Screening Level:**

$$\frac{C_{\text{chronic}}(\text{NH}_3)}{\text{HBSL}} = \frac{8.36\text{E} - 01}{1.04\text{E} + 02}$$
$$= 8.02\text{E} - 03 \text{ (or } 0.008) < 1$$

Note that HBSL for NH<sub>3</sub> is based on Region 9's PRG. In this case, the resulting ratio is three orders of magnitude less than one.

Many petroleum hydrocarbons were detected but do not have specific screening levels. Therefore, the approach recommended by the Total Petroleum Criteria Working Group (Reference 12) was adopted to evaluate petroleum hydrocarbon mixtures. Based on the working group's assessment of various hydrocarbons, they recommended that mixtures be separated according to a substance's number of carbons and its chemical class (i.e., aliphatic or aromatic<sup>1</sup>). Generally, as a substance's carbon number increases, its molecular weight increases and it is, therefore, not a substance of concern via inhalation. The working group has also concluded that aromatic hydrocarbons tend to be more toxic than aliphatic hydrocarbons (Reference 12). Table 7 tabulates the inhalation toxicity values used to evaluate exposure to petroleum mixtures. To be consistent with the methodology used in this assessment, the reference concentrations (RfCs) were converted to PRGs using Region 9 exposure assumptions. The resulting PRGs were used as the HBSLs for the petroleum hydrocarbons in this assessment. These values are presented in Appendix D.

**TABLE 7: SUMMARY OF RfCs USED FOR PETROLEUM HYDROCARBONS<sup>1</sup>**

Carbon Range	Aromatic Inhalation RfC (mg/m <sup>3</sup> )	Aliphatic Inhalation RfC (mg/m <sup>3</sup> )
C <sub>5</sub> – C <sub>6</sub> C <sub>&gt;6</sub> – C <sub>8</sub>		18.4
C <sub>&gt;7</sub> – C <sub>8</sub>	0.4	
C <sub>&gt;8</sub> – C <sub>10</sub> C <sub>&gt;10</sub> – C <sub>12</sub> C <sub>&gt;12</sub> – C <sub>16</sub>	0.2	1.0
C <sub>&gt;16</sub> – C <sub>21</sub> C <sub>&gt;21</sub> – C <sub>35</sub>	NA	NA
NA = not applicable for high molecular weight TPHs (C <sub>&gt;16</sub> ) because compounds in this carbon range are not volatile and therefore, inhalation is not a pathway of concern. <sup>1</sup> Reference 12		

### 6.3.2 ACUTE ASSESSMENT

An established method for assessing acute health effects is not currently available. In 1995 the EPA recognized the need for acute exposure guidelines for emergency response purposes and created the National Advisory Committee for Acute Exposure Guideline Levels (AEGLs) for Hazardous Substances. Currently, AEGLs are only available for only a few substances.

To overcome the absence of acute toxicity data, several state regulatory agencies have suggested that guidelines developed for emergency purposes be used in the interim. Although there have been suggestions to use occupational exposure limits

<sup>1</sup> Aliphatic hydrocarbons are hydrocarbons in which the carbon atoms are joined by single covalent bonds consisting of two shared electrons (e.g., butane). Aromatic hydrocarbons have ring structures (e.g., benzene). Source: Reference 13

(OELs) by applying additional safety factors (References 14, 15), OELs were not used in this assessment because they introduce even more uncertainty than the use of emergency guidelines. The OELs are designed to protect the workplace environment and assume 8 hours a day, 5 days a week exposures. By definition, these exposures are more chronic than acute.

In comparison, emergency planning guidelines are more appropriate because they are typically developed for exposures of 1-hour or less. In addition, safety factors are included as part of the guideline development, so that the values are protective of the general population.

Emergency Response Planning Guidelines (ERPG) published by the American Industrial Hygiene Association (AIHA) (Reference 16) and the Temporary Emergency Exposure Limits (TEELs) developed by the Department of Energy (DOE) (Reference 17) were also used for this assessment, specifically the ERPG-1s and the TEEL-1s. Since TEEL-1s are intended for exposures up to 15-minutes, air concentrations compared to TEELs were averaged over a 15-minute period. Air concentrations compared to the ERPGs and AEGLs were averaged over 1-hour, as these values are intended for 1-hour exposures.

For this study, the hierarchy of sources for ATV selection was as follows with each ATV defined below:

- EPA AEGL-1. "AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic, nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure."
- AIHA ERPG-1. "The maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."
- DOE TEEL-1. "The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."

AEGLs were used first when available since they are developed specifically for the purpose of acute exposure assessments. The ERPGs were selected next, prior to a substance's TEEL, because they are vigorously reviewed before they are published whereas the TEELs are not.

Example 10 shows a sample calculation of how a substance's estimated acute concentration was compared to its acute toxicity value.

### Example 10

#### Sample Calculation Comparing a Substance's Estimated Acute Concentration to Its Acute Toxicity Value:

$$\frac{C_{acute(NH_3)}}{ATV} = \frac{9.33E+02}{1.75E+04}$$
$$= 5.33E-02 \text{ (or } 0.05) < 1$$

Note that ATV in this example is based on NH<sub>3</sub>'s ERPG-1. In this case, the resulting ratio is less than one, indicating that further analysis is not necessary.

## 7. RISK CHARACTERIZATION

As previously described, the exposure assessment included calculations of time-averaged concentrations for both long-term (chronic) and short-term (acute) exposures. Using a screening approach, a substance's estimated time-averaged air concentration was then compared to chronic HBSLs or ATVs. The comparison was made using the ratio of the HBSL or ATV to the estimated concentration. This approach is conservative because the exposure assumptions used by the EPA, to establish HBSLs and ATVs, are likely to overestimate the exposures experienced by offsite residents living near training areas.

If this ratio was less than one, no further evaluation was needed. If the chronic or acute averaged concentrations ( $C_{chronic}$  and  $C_{acute}$ ) were greater than the screening levels, resulting in a ratio greater than one, further evaluation would be warranted to determine the potential for health effects. Note that concentrations greater than the screening levels do not indicate an onset of health effects, but rather, the potential for such.

The chronic and acute assessments were conducted as outlined in Section 6.3. Appendix D presents results for the five different test conditions. Results are provided for air concentrations estimated for both 100 meters and 200 meters downwind from the firing location.

### 7.1 CHRONIC HEALTH RISK

The chronic assessment, at the 100-meters downwind hypothetical resident location, indicated that two of the five test conditions had estimated chromium concentrations that were greater than the HBSL. The ratios of all other substances for these two conditions, except for carbon monoxide, were all well below one. Since the 100 meters location was used as an initial evaluation, the air model was remodeled to a distance 200 meters downwind from the firing point location. The results showed that the estimated air concentrations of chromium for the two test conditions indicated above



decreased to levels below chromium's HBSL. In addition, the estimated air concentrations of all other substances were also significantly reduced. All ratios for the other three test conditions were below one. Therefore, no further analysis was conducted.

Both test conditions, resulting in estimated chromium concentrations greater than the HBSL, involved the use of charge M3, fired from the M199 cannon, and for both zones 3 and 5. The ratios of the estimated chromium concentrations to the HBSL were 2.5 and 2.1, respectively. The HBSL for chromium is based on a carcinogenic endpoint. It should be noted, again, that exceedance of the HBSL does not indicate onset of health effects. In addition, for this assessment, the total chromium concentration was assumed to be present as Cr (VI), the most toxic form via inhalation. It is likely that the estimated Cr (VI) concentration would be much lower since it is highly unstable in the environment.

The ratios of estimated carbon monoxide concentrations were below one for each of the five test conditions. However, the ratios resulting from use of the charge M3, when fired from the M199 cannon for zones 3 and 5, were not significantly less than one (0.586 and 0.963, respectively). Since carbon monoxide is not carcinogenic, the health effects of carbon monoxide and chromium cannot be added together.

## 7.2 ACUTE HEALTH RISK

All test conditions, with the exception of one, had ratios at or below one for the acute assessment. The test condition for which an exceedance occurred was for copper from the charge M3, zone 5, fired from the M199 cannon. All ratios for other substances were below one. The concentration of copper decreased to a safe level when the distance of the hypothetical downwind resident increased from 100 to 200 meters. Therefore, no further evaluation was conducted. Modeled air concentrations for other substances were further decreased when the downwind distance was increased from 100 to 200 meters.

Results indicated that at a distance 100 meters from the firing point location the ratio for copper was 1.26. Acute health effects from exposure to copper can result in eye and respiratory irritation. At the increased distance of 200 meters, the ratio of the estimated copper concentration to its ATV was reduced to 0.52.

## 7.3 FACT SHEET

Appendix E includes a copy of the fact sheet submitted to the USAEC. The fact sheet used the results from this assessment to summarize health concerns related to inhalation of the air emissions from the 155-mm propelling charge.

## 8. UNCERTAINTY DISCUSSION

The limitations inherent in modeling and the added conservatism of the evaluation contribute to the uncertainty of the assessment results. In addition, the risk assessment



methodology typically may include safety factors that are embedded in the toxicity data to ensure adequate protection of the general population, particularly, susceptible individuals such as children, the sick, and the elderly. Table 8 identifies various areas of uncertainty related to this assessment.

**TABLE 8: TYPES OF UNCERTAINTY**

Issue	Uncertainty	Direction of Effect
<b>Emissions Modeling</b>		
Modeled versus real-time sampling	The air concentrations in this assessment were modeled. Actual air concentrations taken from the field may be higher or lower.	Varies
Hypothetical resident assumed to be located directly downwind	Unless the area around the training facility is populated, the chances that a person living directly downwind is low.	Overestimates
Frequency of use for 155-mm propelling charge	Actual frequency of use of 155-mm propelling charge during training exercises may be different from those stated in this report.	Varies
Using worst-case meteorological conditions	To ensure that this assessment may be applicable to all training areas, worst-case meteorological conditions were used in the air model runs.	Overestimates
<b>Exposure Assessment</b>		
Estimating time-averaged concentrations	Actual exposure from the 155-mm propelling charge is intermittent. If one were to plot a person's exposure profile, the plot would consist of a series of spikes. Since current risk assessment methodology does not allow the evaluation of potential health risks as a function of time, a single concentration, averaged over the exposure duration was used. In this assessment, the exposure durations used were 30 years and 1-hour or 15 minutes.	Varies
Chromium speciation	All chromium was assumed to be Cr (VI), which is more toxic than Cr (III).	Overestimates
Comparing estimated concentrations to established screening levels	The Region 3 and Region 9 health-based screening levels were developed using different exposure assumptions from those in this assessment. In this case, these assumptions resulted in	Overestimates

Issue	Uncertainty	Direction of Effect
	more conservative screening levels.	
Screening assessment versus calculating an average daily intake	Calculating an average daily intake allows the use of scenario-specific assumptions.	Varies
Exposure to other munitions	Other munitions are typically used during the same training event. These items may contain substances that are similar or different from those detected in the 155-mm propelling charge.	Underestimates
<b>Toxicity Assessment</b>		
Lack of toxicity data	Some substances were not quantitatively evaluated because they have no known toxicity data.	Underestimates
Modifying and uncertainty factors for toxicity data	Modifying factors and uncertainty factors of varying degree are typically applied to toxicological values. These factors are used to account for different conditions such as extrapolating from animal studies for human health evaluation.	Overestimates
Substances that produce the same toxic endpoint or affect the same target organ	Although conservative assumptions are used in a screening methodology, this approach does not consider exposure to multiple substances. However, unless a substance's concentration compared to its screening level approaches one, a screening assessment is useful as a first-cut evaluation.	Underestimates

## 9. CONCLUSION

Using conservative assumptions, the assessment indicated that offsite residents who live as close as 200 meters directly downwind from the firing location are safe from inhalation of the air emissions from the 155-mm propelling charge. It is believed that the assumptions contained in this assessment are conservative enough to be protective of all the population including the sick, elderly, and children.

## 10. RECOMMENDATIONS

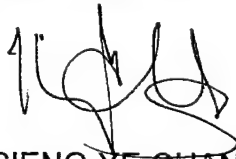
At installations where offsite residents are located less than 200 meters from the 155-mm propelling charge firing location, a more site-specific evaluation is recommended. However, it should be noted that at most training installations, training areas are over 1,000 meters (over half a mile) away from populated areas.

The results from this assessment are intended for a hypothetical training facility and actual results may vary depending on site-specific conditions. This assessment used conservative assumptions (e.g., worst-case meteorological conditions) and it is believed that most site-specific analyses would result in even lower concentrations. Therefore, the results from this assessment should be applicable to most training facilities unless site-specific conditions vary significantly.

## 11. POINT OF CONTACT

Questions about this report should be directed to Ms. Joleen Mobley at 1-800-222-9698 (ext 2953) or (410) 436-2953.

PREPARED BY:



HSIENG-YE CHANG, P.E.  
Environmental Engineer  
Environmental Health Risk Assessment  
Program

APPROVED BY:



DAVID L. DAUGHDRILL  
Program Manager  
Environmental Health Risk Assessment



STAFFORD D.F.R. COAKLEY  
Environmental Engineer  
Environmental Health Risk Assessment  
Program

APPENDIX A  
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## APPENDIX B

### AIR DISPERSION MODELING OUTPUT DATA

**AIR MODELING OUTPUT DATA FOR CHARGE M3,  
FIRED FROM THE M199 CANNON, ZONE 3,  
100 METERS DOWNWIND**



Table B-1: Air Modeling Output Data for Gases, Metals, and Particulates - 100 meter location

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540					No. of rounds (l) release duration (t): Unit Concentration (UC):		1 rounds 2 seconds 1.608E-04 (g/m³)/(g/s)	
Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939								
Compound	ATC Emissions Results				Total Mass of Substance Emitted (grams/item)  M	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER₁	
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)				
Gases								
NH3	3.570E+00	NA	4.120E-02	1.256E-02	1.869E+01	1.503E-03	9.344E+00	
CO2	5.580E+01	NA	6.440E-01	1.963E-01	2.921E+02	2.349E-02	1.461E+02	
CO	1.564E+02	NA	1.805E+00	5.503E-01	8.187E+02	6.583E-02	4.094E+02	
NOx (as NO)	1.107E+00	NA	1.278E-02	3.895E-03	5.795E+00	4.659E-04	2.898E+00	
CH4	2.178E+00	NA	ND	ND	ND	ND	ND	
SO2	5.240E-01	NA	ND	ND	ND	ND	ND	
Combined Particulate								
TSP	6.836E+00	5.300E-02	8.337E-02	2.542E-02	3.782E+01	3.040E-03	1.891E+01	
PM10	5.179E+00	4.233E-02	6.313E-02	1.925E-02	2.863E+01	2.302E-03	1.432E+01	
PM2.5	2.036E+00	2.400E-02	2.473E-02	7.539E-03	1.122E+01	9.018E-04	5.608E+00	
Metals								
Antimony	1.859E-04	4.345E-06	2.231E-06	6.803E-07	1.012E-03	8.138E-08	5.061E-04	
Arsenic	3.717E-04	3.091E-06	4.531E-06	1.381E-06	2.055E-03	1.652E-07	1.028E-03	
Barium	9.513E-03	3.255E-05	1.165E-04	3.552E-05	5.285E-02	4.249E-06	2.643E-02	
Beryllium	7.873E-05	1.649E-06	ND	ND	ND	ND	ND	
Cadmium	1.608E-04	1.649E-06	1.976E-06	6.024E-07	8.962E-04	7.206E-08	4.481E-04	
Chromium	1.400E-03	7.167E-06	1.711E-05	5.218E-06	7.763E-03	6.241E-07	3.881E-03	
Cobalt	1.247E-04	3.763E-06	1.486E-06	4.530E-07	6.740E-04	5.419E-08	3.370E-04	
Copper	1.115E+00	1.159E-03	1.370E-02	4.175E-03	6.212E+00	4.995E-04	3.106E+00	
Lead	2.187E-02	6.770E-05	2.680E-04	8.170E-05	1.215E-01	9.773E-06	6.077E-02	
Manganese	4.046E-03	3.086E-05	4.935E-05	1.504E-05	2.238E-02	1.800E-06	1.119E-02	
Nickel	2.515E-03	1.433E-05	3.073E-05	9.370E-06	1.394E-02	1.121E-06	6.970E-03	
Selenium	2.624E-04	5.497E-06	ND	ND	ND	ND	ND	
Silver	6.997E-05	1.099E-06	8.600E-07	2.622E-07	3.901E-04	3.136E-08	1.950E-04	
Thallium	7.873E-05	1.613E-06	ND	ND	ND	ND	ND	
Zinc	1.596E-01	1.445E-04	1.960E-03	5.977E-04	8.892E-01	7.149E-05	4.446E-01	

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-2: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (l): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER₁
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939						
	ATC Firing Test Results						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.028E-03	6.696E-03	2.867E-05	8.739E-06	1.300E-02	1.045E-06	6.501E-03
Dichloromethane	1.607E-01	5.722E-03	1.904E-03	5.806E-04	8.638E-01	6.945E-05	4.319E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.965E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.007E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	5.931E-02	2.329E-03	7.290E-04	2.223E-04	3.307E-01	2.659E-05	1.653E-01
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	5.333E-03	3.610E-03	2.118E-05	6.456E-06	9.606E-03	7.723E-07	4.803E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-2: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.939						
Air Firing Test Results							
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.218E+00	1.364E+00	1.050E-02	3.202E-03	4.764E+00	3.831E-04	2.382E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.939						
Air Modeling Test Results							
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
SVOCs							
n-nitrosodimethylamine	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
phenol	7.294E-03	7.120E-03	2.148E-06	6.548E-07	9.742E-04	7.833E-08	4.871E-04
2-chlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.355E-03	5.664E-05	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
benzyl alcohol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
hexachloroethane	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
nitrobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
isophorone	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitrophenol	2.355E-03	3.660E-04	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
naphthalene	3.597E-03	1.366E-04	4.253E-05	1.297E-05	1.929E-02	1.551E-06	9.647E-03
4-chloroaniline	2.355E-02	5.605E-04	ND	ND	ND	ND	ND
hexachlorobutadiene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylnaphthalene	2.355E-03	1.694E-04	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND

Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28		SF6 Leak Rate Dilution Factor => 0.939				
	ATC Firing Test Results						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
2,4,5-trichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-chloronaphthalene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitroaniline	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
dimethylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.355E-03	5.721E-05	ND	ND	ND	ND	ND
3-nitroaniline	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
2,4-dinitrophenol	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
dibenzofuran	2.355E-03	7.823E-05	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitrophenol	4.710E-03	1.316E-04	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
diethylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitroaniline	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
hexachlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
pentachlorophenol	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
di-n-butylphthalate	2.355E-03	1.080E-04	ND	ND	ND	ND	ND
butylbenzylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	1.526E-01	9.023E-04	1.865E-03	5.685E-04	8.458E-01	6.801E-05	4.229E-01
di-n-octylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND

Footnotes:

1. ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-4: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases

100 meter location

155mm propelling charge M3 (zone 3), M199 cannon		No. of rounds (I) release duration (I): Unit Concentration (UC):		1 rounds 2 seconds 1.608E-04 (g/m <sup>3</sup> )/(g/s)		
DODIC: D540		3.28				
Net Explosive Weight (NEW) in lbs. =>		3.28				
SF6 Leak Rate Dilution Factor =>		0.939				
Number of Items = 1						
Compound	Average Adjusted Emission Factor				Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>i</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)		
PAHs (TO-13 Method)						
acenaphthylene	4.939E-04	1.328E-06	6.054E-06	1.846E-06	2.746E-03	1.373E-03
acenaphthene	1.464E-04	9.544E-05	6.269E-07	1.911E-07	2.843E-04	1.422E-04
fluorene	2.220E-04	6.502E-05	1.930E-06	5.884E-07	8.754E-04	4.377E-04
phenanthrene	5.217E-04	6.428E-05	5.622E-06	1.714E-06	2.550E-03	1.275E-03
anthracene	5.075E-05	4.197E-06	5.721E-07	1.744E-07	2.595E-04	1.298E-04
fluoranthene	3.162E-04	7.852E-06	3.790E-06	1.155E-06	1.719E-03	8.594E-04
pyrene	8.843E-04	6.908E-06	1.078E-05	3.288E-06	4.892E-03	2.446E-03
benzo(a)anthracene	4.504E-05	1.390E-07	5.518E-07	1.682E-07	2.503E-04	1.252E-04
chrysene	4.510E-05	3.878E-07	5.496E-07	1.676E-07	2.493E-04	1.246E-04
benzo(b)fluoranthene	6.923E-05	2.220E-07	8.482E-07	2.586E-07	3.847E-04	1.924E-04
benzo(k)fluoranthene	9.756E-05	8.926E-08	1.198E-06	3.652E-07	5.434E-04	2.717E-04
benzo(a)pyrene	1.560E-04	8.980E-08	1.917E-06	5.843E-07	8.693E-04	4.347E-04
indeno(1,2,3-cd)pyrene	2.926E-04	1.659E-07	3.595E-06	1.096E-06	1.630E-03	8.152E-04
dibenz(a,h)anthracene	1.008E-05	5.605E-08	1.238E-07	3.776E-08	5.618E-05	2.809E-05
benzo(g,h,i)perylene	6.659E-04	2.408E-07	8.181E-06	2.494E-06	3.711E-03	1.856E-03
Dioxin/Furan Data						
2378-TCDD	4.360E-10	8.000E-12	5.359E-12	1.634E-12	2.431E-09	1.215E-09
12378-PECDD	1.341E-09	9.000E-12	1.637E-11	4.991E-12	7.426E-09	3.713E-09
123478-HXCDD	1.989E-09	1.050E-11	2.445E-11	7.453E-12	1.109E-08	5.544E-09
123678-HXCDD	5.812E-09	1.700E-11	7.122E-11	2.171E-11	3.230E-08	1.615E-08
123789-HXCDD	5.536E-09	1.550E-11	6.785E-11	2.068E-11	3.077E-08	1.539E-08
1234678-HPCDD	1.137E-07	2.495E-10	1.395E-09	4.252E-10	6.327E-07	3.163E-07
OCDD	6.470E-07	1.587E-09	7.932E-09	2.418E-09	3.598E-06	1.799E-06
2378-TCDF	1.560E-10	1.100E-11	1.782E-12	5.433E-13	8.084E-10	4.042E-10
12378-PECDF	2.870E-10	1.050E-11	ND	ND	ND	ND
23478-PECDF	1.870E-10	1.550E-11	2.108E-12	6.427E-13	9.561E-10	4.781E-10
123478-HXCDF	3.965E-10	2.800E-11	4.529E-12	1.381E-12	2.054E-09	1.027E-09
123678-HXCDF	2.380E-10	1.450E-11	2.747E-12	8.375E-13	1.246E-09	6.230E-10
123789-HXCDF	3.015E-10	6.000E-12	ND	ND	ND	ND

**Table B-4: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>i</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939						
	ATC Firing Test Results						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	2.450E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	4.119E-09	7.750E-11	4.967E-11	1.514E-11	2.253E-08	1.811E-12	1.126E-08
1234789-HPCDF	6.770E-10	8.000E-12	8.223E-12	2.507E-12	3.730E-09	2.999E-13	1.865E-09
OCDF	1.221E-08	1.105E-10	1.488E-10	4.536E-11	6.748E-08	5.425E-12	3.374E-08
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	2.375E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	1.229E-01	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND

Footnotes:

"ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-5: Air Modeling Output Data for Cyanide and Energetics - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28						
	SF6 Leak Rate Dilution Factor => 0.939						
	ATC Firing Test Results						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	9.500E-01	8.500E-02	1.168E-02	3.560E-03	5.296E+00	4.258E-04	2.648E+00
Energetics Data							
Nitrobenzene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	1.004E+00	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritoltrinitrate	1.004E+00	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.510E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.510E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.255E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
1ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							



**AIR MODELING OUTPUT DATA FOR CHARGE M3,  
FIRED FROM THE M199 CANNON, ZONE 3,  
200 METERS DOWNWIND**

**Table B-6: Air Modeling Output Data for Gases, Metals, and Particulates - 200 meter location**

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIG: D540					No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939							
	Caching Results							
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M			
<b>Gases</b>								
NH3	3.570E+00	NA	4.120E-02	1.256E-02	1.869E+01	3.230E-04	4.672E+00	
CO2	5.580E+01	NA	6.440E-01	1.963E-01	2.921E+02	5.049E-03	7.303E+01	
CO	1.564E+02	NA	1.805E+00	5.503E-01	8.187E+02	1.415E-02	2.047E+02	
NOx (as NO)	1.107E+00	NA	1.278E-02	3.895E-03	5.795E+00	1.002E-04	1.449E+00	
CH4	2.178E+00	NA	ND	ND	ND	ND	ND	
SO2	5.240E-01	NA	ND	ND	ND	ND	ND	
<b>Combined Particulate</b>								
TSP	6.836E+00	5.300E-02	8.337E-02	2.542E-02	3.782E+01	6.536E-04	9.454E+00	
PM10	5.179E+00	4.233E-02	6.313E-02	1.925E-02	2.863E+01	4.949E-04	7.159E+00	
PM2.5	2.036E+00	2.400E-02	2.473E-02	7.539E-03	1.122E+01	1.939E-04	2.804E+00	
<b>Metals</b>								
Antimony	1.859E-04	4.345E-06	2.231E-06	6.803E-07	1.012E-03	1.750E-08	2.530E-04	
Arsenic	3.717E-04	3.091E-06	4.531E-06	1.381E-06	2.055E-03	3.552E-08	5.138E-04	
Barium	9.513E-03	3.255E-05	1.165E-04	3.552E-05	5.285E-02	9.135E-07	1.321E-02	
Beryllium	7.873E-05	1.649E-06	ND	ND	ND	ND	ND	
Cadmium	1.608E-04	1.649E-06	1.976E-06	6.024E-07	8.962E-04	1.549E-08	2.241E-04	
Chromium	1.400E-03	7.167E-06	1.711E-05	5.218E-06	7.763E-03	1.342E-07	1.941E-03	
Cobalt	1.247E-04	3.763E-06	1.486E-06	4.530E-07	6.740E-04	1.165E-08	1.685E-04	
Copper	1.115E+00	1.159E-03	1.370E-02	4.175E-03	6.212E+00	1.074E-04	1.553E+00	
Lead	2.187E-02	6.770E-05	2.680E-04	8.170E-05	1.215E-01	2.101E-06	3.039E-02	
Manganese	4.046E-03	3.086E-05	4.935E-05	1.504E-05	2.238E-02	3.869E-07	5.596E-03	
Nickel	2.515E-03	1.433E-05	3.073E-05	9.370E-06	1.394E-02	2.410E-07	3.485E-03	
Selenium	2.624E-04	5.497E-06	ND	ND	ND	ND	ND	
Silver	6.997E-05	1.099E-06	8.600E-07	2.622E-07	3.901E-04	6.743E-09	9.752E-05	
Thallium	7.873E-05	1.613E-06	ND	ND	ND	ND	ND	
Zinc	1.596E-01	1.445E-04	1.960E-03	5.977E-04	8.892E-01	1.537E-05	2.223E-01	

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-7: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER₁
	Net Explosive Weight (NEW) in lbs. => 3.28						
	SF6 Leak Rate Dilution Factor => 0.939						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.028E-03	6.696E-03	2.867E-05	8.739E-06	1.300E-02	2.247E-07	3.251E-03
Dichloromethane	1.607E-01	5.722E-03	1.904E-03	5.806E-04	8.638E-01	1.493E-05	2.160E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.965E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.007E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	5.931E-02	2.329E-03	7.290E-04	2.223E-04	3.307E-01	5.716E-06	8.267E-02
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	5.333E-03	3.610E-03	2.118E-05	6.456E-06	9.606E-03	1.660E-07	2.401E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethane	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-7: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (l): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor EF	Average Adjusted Emission Factor (lb/lb NEW)			
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.218E+00	1.364E+00	1.050E-02	3.202E-03	4.764E+00	8.235E-05	1.191E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:  
ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Table B-8: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (l): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28						
	SF6 Leak Rate Dilution Factor => 0.939						
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
SVOCs							
n-nitrosodimethylamine	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
phenol	7.294E-03	7.120E-03	2.148E-06	6.548E-07	9.742E-04	1.684E-08	2.436E-04
2-chlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.355E-03	5.664E-05	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
benzyl alcohol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
hexachloroethane	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
nitrobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
isophorone	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitrophenol	2.355E-03	3.660E-04	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
naphthalene	3.597E-03	1.366E-04	4.253E-05	1.297E-05	1.929E-02	3.335E-07	4.823E-03
4-chloroaniline	2.355E-02	5.605E-04	ND	ND	ND	ND	ND
hexachlorobutadiene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylnaphthalene	2.355E-03	1.694E-04	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND

Table B-8: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28						
	SF6 Leak Rate Dilution Factor => 0.939						
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
2,4,5-trichlorophenol	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-chloronaphthalene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitroaniline	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
dimethylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.355E-03	5.721E-05	ND	ND	ND	ND	ND
3-nitroaniline	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
2,4-dinitrophenol	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
dibenzofuran	2.355E-03	7.823E-05	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitrophenol	4.710E-03	1.316E-04	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
diethylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitroaniline	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
hexachlorobenzene	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
pentachlorophenol	4.710E-03	1.121E-04	ND	ND	ND	ND	ND
di-n-butylphthalate	2.355E-03	1.080E-04	ND	ND	ND	ND	ND
butylbenzylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	1.526E-01	9.023E-04	1.865E-03	5.685E-04	8.458E-01	1.462E-05	2.115E-01
di-n-octylphthalate	2.355E-03	5.605E-05	ND	ND	ND	ND	ND

Footnotes:  
ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected



Table B-9: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases

200 meter location

200 meter location		155mm propelling charge M3 (zone 3), M198 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	1 rounds 4 seconds 6.914E-05 (g/m³)/(g/s)
		Net Explosive Weight (NEW) in lbs. => 3.28					
		SF6 Leak Rate Dilution Factor => 0.939					
Compound	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
PAHs (TO-13 Method)							
acenaphthylene	4.939E-04	1.328E-06	6.054E-06	1.846E-06	2.746E-03	4.747E-08	6.866E-04
acenaphthene	1.464E-04	9.544E-05	6.269E-07	1.911E-07	2.843E-04	4.915E-09	7.109E-05
fluorene	2.220E-04	6.502E-05	1.930E-06	5.884E-07	8.754E-04	1.513E-08	2.188E-04
phenanthrene	5.217E-04	6.428E-05	5.622E-06	1.714E-06	2.550E-03	4.408E-08	6.375E-04
anthracene	5.075E-05	4.197E-06	5.721E-07	1.744E-07	2.595E-04	4.486E-09	6.488E-05
fluoranthene	3.162E-04	7.852E-06	3.790E-06	1.155E-06	1.719E-03	2.971E-08	4.297E-04
pyrene	8.843E-04	6.908E-06	1.078E-05	3.288E-06	4.892E-03	8.455E-08	1.223E-03
benzo(a)anthracene	4.504E-05	1.390E-07	5.518E-07	1.682E-07	2.503E-04	4.327E-09	6.258E-05
chrysene	4.510E-05	3.878E-07	5.496E-07	1.676E-07	2.493E-04	4.309E-09	6.232E-05
benzo(b)fluoranthene	6.923E-05	2.220E-07	8.482E-07	2.586E-07	3.847E-04	6.650E-09	9.618E-05
benzo(k)fluoranthene	9.756E-05	9.826E-08	1.198E-06	3.652E-07	5.434E-04	9.392E-09	1.358E-04
benzo(a)pyrene	1.560E-04	8.980E-08	1.917E-06	5.843E-07	8.693E-04	1.503E-08	2.173E-04
indeno(1,2,3-cd)pyrene	2.926E-04	1.659E-07	3.595E-06	1.096E-06	1.630E-03	2.818E-08	4.076E-04
dibenz(a,h)anthracene	1.008E-05	5.605E-08	1.238E-07	3.776E-08	5.618E-05	9.710E-10	1.404E-05
benzo(g,h,i)perylene	6.659E-04	2.408E-07	8.181E-06	2.494E-06	3.711E-03	6.415E-08	9.278E-04
Dioxin/Furan Data							
2378-TCDD	4.360E-10	8.000E-12	5.359E-12	1.634E-12	2.431E-09	4.201E-14	6.077E-10
12378-PECDD	1.341E-09	9.000E-12	1.637E-11	4.991E-12	7.426E-09	1.284E-13	1.856E-09
123478-HXCDD	1.989E-09	1.050E-11	2.445E-11	7.453E-12	1.109E-08	1.917E-13	2.772E-09
123678-HXCDD	5.812E-09	1.700E-11	7.122E-11	2.171E-11	3.230E-08	5.584E-13	8.076E-09
123789-HXCDD	5.536E-09	1.550E-11	6.785E-11	2.068E-11	3.077E-08	5.319E-13	7.694E-09
1234678-HPCDD	1.137E-07	2.495E-10	1.395E-09	4.252E-10	6.327E-07	1.094E-11	1.582E-07
OCDD	6.470E-07	1.587E-09	7.932E-09	2.418E-09	3.598E-06	6.219E-11	8.995E-07
2378-TCDF	1.560E-10	1.100E-11	1.782E-12	5.433E-13	8.084E-10	1.397E-14	2.021E-10
12378-PECDF	2.870E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	1.870E-10	1.550E-11	2.108E-12	6.427E-13	9.561E-10	1.653E-14	2.390E-10
123478-HXCDF	3.965E-10	2.800E-11	4.529E-12	1.381E-12	2.054E-09	3.551E-14	5.136E-10
123678-HXCDF	2.380E-10	1.450E-11	2.747E-12	8.375E-13	1.246E-09	2.154E-14	3.115E-10
123789-HXCDF	3.015E-10	6.000E-12	ND	ND	ND	ND	ND

**Table B-9: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	2.450E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	4.119E-09	7.750E-11	4.967E-11	1.514E-11	2.253E-08	3.894E-13	5.632E-09
1234789-HPCDF	6.770E-10	8.000E-12	8.223E-12	2.507E-12	3.730E-09	6.447E-14	9.324E-10
OCDF	1.221E-08	1.105E-10	1.488E-10	4.536E-11	6.748E-08	1.166E-12	1.687E-08
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	2.375E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	1.229E-01	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-10: Air Modeling Output Data for Cyanide and Energetics - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.939						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	9.500E-01	8.500E-02	1.168E-02	3.560E-03	5.296E+00	9.155E-05	1.324E+00
Energetics Data							
Nitrobenzene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	5.021E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	1.004E+00	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritoltrinitrate	1.004E+00	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.510E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.510E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.255E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
1 ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

**AIR MODELING OUTPUT DATA FOR CHARGE M3,  
FIRED FROM THE M284 CANNON, ZONE 3,  
100 METERS DOWNWIND**

**Table B-11: Air Modeling Output Data for Gases, Metals, and Particulates - 100 meter location**

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => Number of Items = 1 SF6 Leak Rate Dilution Factor =>			Total Mass of Substance Emitted (grams/item) M			
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF				
Air Pollution Data							
Gases							
NH3	3.780E+00	NA	4.363E-02	1.330E-02	1.979E+01	1.591E-03	9.894E+00
CO2	6.480E+01	NA	7.479E-01	2.280E-01	3.392E+02	2.727E-02	1.696E+02
CO	1.679E+02	NA	1.938E+00	5.908E-01	8.790E+02	7.067E-02	4.395E+02
NOx (as NO)	1.353E+00	NA	1.562E-02	4.761E-03	7.083E+00	5.695E-04	3.541E+00
CH4	2.178E+00	NA	ND	ND	ND	ND	ND
SO2	5.240E-01	NA	ND	ND	ND	ND	ND
Combined Particulate							
TSP	4.514E+00	5.300E-02	5.746E-02	1.752E-02	2.606E+01	2.096E-03	1.303E+01
PM10	3.875E+00	4.233E-02	4.937E-02	1.505E-02	2.239E+01	1.800E-03	1.120E+01
PM2.5	2.074E+00	2.400E-02	2.641E-02	8.050E-03	1.198E+01	9.630E-04	5.989E+00
Metals							
Antimony	1.819E-04	4.345E-06	ND	ND	ND	ND	ND
Arsenic	2.814E-04	3.091E-06	3.585E-06	1.093E-06	1.626E-03	1.308E-07	8.131E-04
Barium	2.814E-03	3.255E-05	3.583E-05	1.092E-05	1.625E-02	1.307E-06	8.126E-03
Beryllium	7.796E-05	1.649E-06	ND	ND	ND	ND	ND
Cadmium	7.796E-05	1.649E-06	ND	ND	ND	ND	ND
Chromium	4.978E-04	7.167E-06	6.320E-06	1.927E-06	2.867E-03	2.305E-07	1.433E-03
Cobalt	8.659E-05	3.763E-06	1.067E-06	3.253E-07	4.839E-04	3.891E-08	2.420E-04
Copper	2.598E-01	1.159E-03	3.331E-03	1.016E-03	1.511E+00	1.215E-04	7.555E-01
Lead	2.381E-02	6.770E-05	3.059E-04	9.325E-05	1.387E-01	1.115E-05	6.937E-02
Manganese	1.992E-03	3.086E-05	2.526E-05	7.700E-06	1.146E-02	9.211E-07	5.728E-03
Nickel	8.659E-04	1.433E-05	1.097E-05	3.344E-06	4.975E-03	4.000E-07	2.488E-03
Selenium	2.599E-04	5.497E-06	ND	ND	ND	ND	ND
Silver	5.197E-05	1.099E-06	ND	ND	ND	ND	ND
Thallium	7.796E-05	1.613E-06	ND	ND	ND	ND	ND
Zinc	4.544E-02	1.445E-04	5.835E-04	1.779E-04	2.647E-01	2.128E-05	1.323E-01

Footnotes:

ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-12: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.28 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.339E-03	6.696E-03	3.405E-05	1.038E-05	1.544E-02	1.242E-06	7.722E-03
Dichloromethane	2.436E-01	5.722E-03	3.064E-03	9.341E-04	1.390E+00	1.117E-04	6.948E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	5.148E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	7.867E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	4.807E-02	2.329E-03	6.192E-04	1.888E-04	2.808E-01	2.258E-05	1.404E-01
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	4.247E-03	3.610E-03	8.207E-06	2.502E-06	3.723E-03	2.993E-07	1.861E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-12: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.023E+00	1.364E+00	8.488E-03	2.588E-03	3.850E+00	3.095E-04	1.925E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:  
1 ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-13: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
<b>SVOCs</b>							
n-nitrosodimethylamine	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
phenol	2.058E-02	1.923E-02	1.743E-05	5.314E-06	7.908E-03	6.357E-07	3.953E-03
2-chlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
benzyl alcohol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-methylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
hexachloroethane	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-methylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
nitrobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
isophorone	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-nitrophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
naphthalene	3.659E-03	2.236E-03	4.713E-05	1.437E-05	2.138E-02	1.719E-06	1.069E-02
4-chloroaniline	2.572E-02	2.236E-02	ND	ND	ND	ND	ND
hexachlorobutadiene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-methylnaphthalene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND



Table B-13: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.898						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
2,4,5-trichlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-chloronaphthalene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-nitroaniline	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
dimethylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
3-nitroaniline	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
2,4-dinitrophenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
dibenzofuran	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-nitrophenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
diethylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-nitroaniline	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
hexachlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
pentachlorophenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
di-n-butylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
butylbenzylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	1.269E-01	5.813E-02	8.853E-04	2.699E-04	4.015E-01	3.228E-05	2.008E-01
di-n-octylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND

Footnotes:  
'ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

**Table B-14: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER₁
	Net Explosive Weight (NEW) In lbs. => 3.28						
	SF6 Leak Rate Dilution Factor => 0.898						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
PAHs (TO-13 Method)							
acenaphthylene	5.945E-04	6.260E-06	7.578E-06	2.310E-06	3.437E-03	2.763E-07	1.719E-03
acenaphthene	2.275E-04	9.166E-05	1.750E-06	5.334E-07	7.936E-04	6.381E-08	3.968E-04
fluorene	2.944E-04	8.495E-05	2.698E-06	8.224E-07	1.224E-03	9.838E-08	6.118E-04
phenanthrene	5.287E-04	1.453E-04	4.938E-06	1.506E-06	2.240E-03	1.801E-07	1.120E-03
anthracene	6.603E-05	6.707E-06	7.641E-07	2.330E-07	3.466E-04	2.787E-08	1.733E-04
fluoranthene	2.244E-04	2.459E-05	2.573E-06	7.845E-07	1.167E-03	9.384E-08	5.836E-04
pyrene	5.831E-04	2.191E-05	7.229E-06	2.204E-06	3.279E-03	2.636E-07	1.639E-03
benzo(a)anthracene	3.944E-05	2.236E-06	5.081E-07	1.549E-07	2.305E-04	1.853E-08	1.152E-04
chrysene	3.830E-05	2.236E-06	4.933E-07	1.504E-07	2.238E-04	1.799E-08	1.119E-04
benzo(b)fluoranthene	8.890E-05	3.353E-06	1.102E-06	3.360E-07	4.998E-04	4.019E-08	2.499E-04
benzo(k)fluoranthene	7.431E-05	2.459E-06	9.255E-07	2.822E-07	4.198E-04	3.375E-08	2.099E-04
benzo(a)pyrene	1.409E-04	2.906E-06	1.778E-06	5.420E-07	8.063E-04	6.483E-08	4.032E-04
indeno(1,2,3-cd)pyrene	2.218E-04	7.601E-06	2.759E-06	8.412E-07	1.252E-03	1.006E-07	6.258E-04
dibenz(a,h)anthracene	8.432E-06	3.130E-06	6.829E-08	2.082E-08	3.098E-05	2.490E-09	1.549E-05
benzo(g,h,i)perylene	5.202E-04	1.185E-05	6.548E-06	1.996E-06	2.970E-03	2.388E-07	1.485E-03
Dioxin/Furan Data							
2378-TCDD	7.755E-10	8.000E-12	9.989E-12	3.045E-12	4.531E-09	3.643E-13	2.265E-09
12378-PECDD	2.710E-10	9.000E-12	ND	ND	ND	ND	ND
123478-HXGDD	4.990E-10	1.050E-11	ND	ND	ND	ND	ND
123678-HXGDD	6.330E-10	1.700E-11	7.935E-12	2.419E-12	3.599E-09	2.894E-13	1.800E-09
123789-HXGDD	2.635E-10	1.550E-11	3.194E-12	9.739E-13	1.449E-09	1.165E-13	7.245E-10
1234678-HPCDD	5.851E-09	2.495E-10	7.215E-11	2.200E-11	3.272E-08	2.631E-12	1.636E-08
OCDD	4.574E-08	1.587E-09	5.687E-10	1.734E-10	2.580E-07	2.074E-11	1.290E-07
2378-TCDF	5.110E-10	1.100E-11	6.440E-12	1.964E-12	2.921E-09	2.349E-13	1.461E-09
12378-PECDF	2.975E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	2.480E-10	1.550E-11	2.995E-12	9.130E-13	1.358E-09	1.092E-13	6.792E-10
123478-HXGDF	4.410E-10	2.800E-11	5.320E-12	1.622E-12	2.413E-09	1.940E-13	1.206E-09
123678-HXGDF	2.270E-10	1.450E-11	2.737E-12	8.345E-13	1.242E-09	9.982E-14	6.208E-10
123789-HXGDF	2.895E-10	6.000E-12	ND	ND	ND	ND	ND



**Table B-14: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.898						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	2.395E-10	1.200E-11	ND	ND.	ND	ND	ND
1234678-HPCDF	1.954E-09	7.750E-11	2.416E-11	7.367E-12	1.096E-08	8.812E-13	5.480E-09
1234789-HPCDF	2.900E-10	8.000E-12	ND	ND	ND	ND	ND
OCDF	2.410E-09	1.105E-10	2.962E-11	9.030E-12	1.344E-08	1.080E-12	6.718E-09
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	3.563E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	9.828E-02	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	2.050E-01	2.200E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	2.150E-01	1.400E-01	2.769E-03	8.443E-04	1.256E+00	1.010E-04	6.281E-01
Footnotes:							
*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

Table B-15: Air Modeling Output Data for Cyanide and Energetics - 100 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.898						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Aberdeen Test Center (ATC) - Firing Point Emissions Study							
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	1.350E+00	8.500E-02	1.739E-02	5.302E-03	7.888E+00	6.342E-04	3.944E+00
Energetics Data							
Nitrobenzene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.408E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritoltetranitrate	9.408E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.352E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.352E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.176E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
1. ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

## Footnotes:

1. ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

**AIR MODELING OUTPUT DATA FOR CHARGE M3,  
FIRED FROM THE M284 CANNON, ZONE 3,  
200 METERS DOWNWIND**

Table B-16: Air Modeling Output Data for Gases, Metals, and Particulates - 200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540					No. of rounds (I) release duration (I): Unit Concentration (UC):	1 rounds 4 seconds 6.914E-05 (g/m <sup>3</sup> )/(g/s)
Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.896						
Compound	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC					
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb./item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
Gases						
NH3	3.780E+00	NA	4.363E-02	1.330E-02	1.979E+01	3.420E-04
CO2	6.480E+01	NA	7.479E-01	2.280E-01	3.392E+02	5.864E-03
CO	1.679E+02	NA	1.938E+00	5.908E-01	8.790E+02	1.519E-02
NOx (as NO)	1.353E+00	NA	1.562E-02	4.761E-03	7.083E+00	1.224E-04
CH4	2.178E+00	NA	ND	ND	ND	ND
SO2	5.240E-01	NA	ND	ND	ND	ND
Combined Particulate						
TSP	4.514E+00	5.300E-02	5.746E-02	1.752E-02	2.606E+01	4.505E-04
PM10	3.875E+00	4.233E-02	4.937E-02	1.505E-02	2.239E+01	3.871E-04
PM2.5	2.074E+00	2.400E-02	2.641E-02	8.050E-03	1.198E+01	2.070E-04
Metals						
Antimony	1.819E-04	4.345E-06	ND	ND	ND	ND
Arsenic	2.814E-04	3.091E-06	3.585E-06	1.093E-06	1.626E-03	2.811E-08
Barium	2.814E-03	3.255E-05	3.583E-05	1.092E-05	1.625E-02	2.809E-07
Beryllium	7.796E-05	1.649E-06	ND	ND	ND	ND
Cadmium	7.796E-05	1.649E-06	ND	ND	ND	ND
Chromium	4.978E-04	7.167E-06	6.320E-06	1.927E-06	2.867E-03	4.955E-08
Cobalt	8.659E-05	3.763E-06	1.067E-06	3.253E-07	4.839E-04	8.365E-09
Copper	2.598E-01	1.159E-03	3.331E-03	1.016E-03	1.511E+00	2.612E-05
Lead	2.381E-02	6.770E-05	3.059E-04	9.325E-05	1.387E-01	2.398E-06
Manganese	1.992E-03	3.086E-05	2.526E-05	7.700E-06	1.146E-02	1.980E-07
Nickel	8.659E-04	1.433E-05	1.097E-05	3.344E-06	4.975E-03	8.600E-08
Selenium	2.599E-04	5.497E-06	ND	ND	ND	ND
Silver	5.197E-05	1.099E-06	ND	ND	ND	ND
Thallium	7.796E-05	1.613E-06	ND	ND	ND	ND
Zinc	4.544E-02	1.445E-04	5.835E-04	1.779E-04	2.647E-01	4.575E-06
						6.617E-02

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-17: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.339E-03	6.696E-03	3.405E-05	1.038E-05	1.544E-02	2.669E-07	3.861E-03
Dichloromethane	2.436E-01	5.722E-03	3.064E-03	9.341E-04	1.390E+00	2.402E-05	3.474E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	5.148E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethane	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	7.867E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	4.807E-02	2.329E-03	6.192E-04	1.888E-04	2.808E-01	4.854E-06	7.021E-02
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	4.247E-03	3.610E-03	8.207E-06	2.502E-06	3.723E-03	6.435E-08	9.307E-04
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-17: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.023E+00	1.364E+00	8.488E-03	2.588E-03	3.850E+00	6.655E-05	9.625E-01
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:  
\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-18: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
SVOCs							
n-nitrosodimethylamine	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
phenol	2.058E-02	1.923E-02	1.743E-05	5.314E-06	7.906E-03	1.367E-07	1.977E-03
2-chlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
benzyl alcohol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-methylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
hexachloroethane	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-methylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
nitrobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
isophorone	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-nitrophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
naphthalene	3.659E-03	2.236E-03	4.713E-05	1.437E-05	2.138E-02	3.695E-07	5.344E-03
4-chloroaniline	2.572E-02	2.236E-02	ND	ND	ND	ND	ND
hexachlorobutadiene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-methylnaphthalene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND

Table B-18: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):		Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => Number of Items = 1 SF6 Leak Rate Dilution Factor =>				Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	1 rounds 4 seconds (g/m <sup>3</sup> )/(g/s) 6.914E-05	
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
2,4,5-trichlorophenol	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-chloronaphthalene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2-nitroaniline	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
dimethylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
3-nitroaniline	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
2,4-dinitrophenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
dibenzofuran	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-nitrophenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
diethylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-nitroaniline	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
hexachlorobenzene	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
pentachlorophenol	5.144E-03	4.471E-03	ND	ND	ND	ND	ND
di-n-butylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
butylbenzylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	1.269E-01	5.813E-02	8.853E-04	2.699E-04	4.015E-01	6.941E-06	1.004E-01
di-n-octylphthalate	2.572E-03	2.236E-03	ND	ND	ND	ND	ND

Footnotes:  
1ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-19: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases  
200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
PAHs (TO-13 Method)							
acenaphthylene	5.945E-04	6.260E-06	7.578E-06	2.310E-06	3.437E-03	5.941E-08	8.593E-04
acenaphthene	2.275E-04	9.166E-05	1.750E-06	5.334E-07	7.936E-04	1.372E-08	1.984E-04
fluorene	2.944E-04	8.495E-05	2.698E-06	8.224E-07	1.224E-03	2.115E-08	3.059E-04
phenanthrene	5.287E-04	1.453E-04	4.938E-06	1.506E-06	2.240E-03	3.872E-08	5.600E-04
anthracene	6.603E-05	6.707E-06	7.641E-07	2.330E-07	3.466E-04	5.991E-09	8.665E-05
fluoranthene	2.244E-04	2.459E-05	2.573E-06	7.845E-07	1.167E-03	2.018E-08	2.918E-04
pyrene	5.831E-04	2.191E-05	7.229E-06	2.204E-06	3.279E-03	5.667E-08	8.197E-04
benzo(a)anthracene	3.944E-05	2.236E-06	5.081E-07	1.549E-07	2.305E-04	3.983E-09	5.761E-05
chrysene	3.830E-05	2.236E-06	4.933E-07	1.504E-07	2.238E-04	3.868E-09	5.594E-05
benzo(b)fluoranthene	8.890E-05	3.353E-06	1.102E-06	3.360E-07	4.998E-04	8.640E-09	1.250E-04
benzo(k)fluoranthene	7.431E-05	2.459E-06	9.255E-07	2.822E-07	4.198E-04	7.256E-09	1.049E-04
benzo(a)pyrene	1.409E-04	2.906E-06	1.778E-06	5.420E-07	8.063E-04	1.394E-08	2.016E-04
indeno(1,2,3-cd)pyrene	2.218E-04	7.601E-06	2.759E-06	8.412E-07	1.252E-03	2.163E-08	3.129E-04
dibenz(a,h)anthracene	8.432E-06	3.130E-06	6.829E-08	2.082E-08	3.098E-05	5.354E-10	7.744E-06
benzo(g,h,i)perylene	5.202E-04	1.185E-05	6.548E-06	1.996E-06	2.970E-03	5.134E-08	7.425E-04
Dioxin/Furan Data							
2378-TCDD	7.755E-10	8.000E-12	9.989E-12	3.045E-12	4.531E-09	7.832E-14	1.133E-09
12378-PECDD	2.710E-10	9.000E-12	ND	ND	ND	ND	ND
123478-HXCDD	4.990E-10	1.050E-11	ND	ND	ND	ND	ND
123678-HXCDD	6.330E-10	1.700E-11	7.935E-12	2.419E-12	3.599E-09	6.221E-14	8.998E-10
123789-HXCDD	2.635E-10	1.550E-11	3.194E-12	9.739E-13	1.449E-09	2.505E-14	3.622E-10
1234678-HPCDD	5.851E-09	2.495E-10	7.215E-11	2.200E-11	3.272E-08	5.656E-13	8.181E-09
OCDD	4.574E-08	1.587E-09	5.687E-10	1.734E-10	2.580E-07	4.459E-12	6.449E-08
2378-TCDF	5.110E-10	1.100E-11	6.440E-12	1.964E-12	2.921E-09	5.049E-14	7.303E-10
12378-PECDF	2.975E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	2.480E-10	1.550E-11	2.995E-12	9.130E-13	1.358E-09	2.348E-14	3.396E-10
123478-HXCDF	4.410E-10	2.800E-11	5.320E-12	1.622E-12	2.413E-09	4.171E-14	6.032E-10
123678-HXCDF	2.270E-10	1.450E-11	2.737E-12	8.345E-13	1.242E-09	2.146E-14	3.104E-10
123789-HXCDF	2.895E-10	6.000E-12	ND	ND	ND	ND	ND

**Table B-19: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>i</sub>
	Net Explosive Weight (NEW) in lbs. => 3.28						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
234678-HXCDF	2.395E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	1.954E-09	7.750E-11	2.416E-11	7.367E-12	1.096E-08	1.895E-13	2.740E-09
1234789-HPCDF	2.900E-10	8.000E-12	ND	ND	ND	ND	ND
OCDF	2.410E-09	1.105E-10	2.962E-11	9.030E-12	1.344E-08	2.322E-13	3.359E-09
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	3.563E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	9.828E-02	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	2.050E-01	2.200E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	2.150E-01	1.400E-01	2.769E-03	8.443E-04	1.256E+00	2.171E-05	3.140E-01
Footnotes:							
ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

Table B-20: Air Modeling Output Data for Cyanide and Energetics - 200 meter location

Compound	155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.28 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.896						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/litem) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	1.350E+00	8.500E-02	1.739E-02	5.302E-03	7.888E+00	1.363E-04	1.972E+00
Energetics Data							
Nitrobenzene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.704E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.408E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritol tetranitrate	9.408E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.352E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.352E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.176E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

**AIR MODELING OUTPUT DATA FOR CHARGE M3,  
FIRED FROM THE M199 CANNON, ZONE 5,  
100 METERS DOWNWIND**

Table B-21: Air Modeling Output Data for Gases, Metals, and Particulates - 100 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540					No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94							
	Number of Items = 1							
	SF6 Leak Rate Dilution Factor => 0.95							
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)				
Gases								
NH3	8.400E+00	NA	9.695E-02	1.632E-02	4.397E+01	3.199E-03	2.199E+01	
CO2	1.080E+02	NA	1.246E+00	2.098E-01	5.654E+02	4.113E-02	2.827E+02	
CO	2.841E+02	NA	3.278E+00	5.519E-01	1.487E+03	1.082E-01	7.435E+02	
NOx (as NO)	3.936E+00	NA	4.543E-02	7.647E-03	2.060E+01	1.499E-03	1.030E+01	
CH4	2.178E+00	NA	ND	ND	ND	ND	ND	
SO2	5.240E-01	NA	ND	ND	ND	ND	ND	
Combined Particulate								
TSP	1.122E+01	5.300E-02	1.356E-01	2.284E-02	6.153E+01	4.476E-03	3.076E+01	
PM10	8.017E+00	4.233E-02	9.688E-02	1.631E-02	4.394E+01	3.197E-03	2.197E+01	
PM2.5	3.180E+00	2.400E-02	3.834E-02	6.455E-03	1.739E+01	1.265E-03	8.696E+00	
Metals								
Antimony	2.819E-04	4.345E-06	3.371E-06	5.676E-07	1.529E-03	1.113E-07	7.846E-04	
Arsenic	6.180E-04	3.091E-06	7.470E-06	1.258E-06	3.389E-03	2.465E-07	1.694E-03	
Barium	6.071E-03	3.255E-05	7.336E-05	1.235E-05	3.327E-02	2.421E-06	1.664E-02	
Beryllium	7.806E-05	1.649E-06	ND	ND	ND	ND	ND	
Cadmium	2.103E-04	1.649E-06	2.555E-06	4.301E-07	1.199E-03	8.431E-08	5.795E-04	
Chromium	1.334E-03	7.167E-06	1.611E-05	2.713E-06	7.309E-03	5.317E-07	3.654E-03	
Cobalt	1.713E-04	3.763E-06	2.035E-06	3.426E-07	9.231E-04	6.716E-08	4.616E-04	
Copper	1.518E+00	1.159E-03	1.842E-02	3.102E-03	8.357E+00	6.080E-04	4.179E+00	
Lead	3.036E-02	6.770E-05	3.680E-04	6.195E-05	1.669E-01	1.214E-05	8.345E-02	
Manganese	7.480E-03	3.086E-05	9.050E-05	1.524E-05	4.105E-02	2.986E-06	2.053E-02	
Nickel	2.494E-03	1.433E-05	3.012E-05	5.071E-06	1.366E-02	9.939E-07	6.831E-03	
Selenium	2.602E-04	5.497E-06	ND	ND	ND	ND	ND	
Silver	1.019E-04	1.099E-06	1.238E-06	2.084E-07	5.615E-04	4.085E-08	2.808E-04	
Thallium	7.806E-05	1.613E-06	ND	ND	ND	ND	ND	
Zinc	2.385E-01	1.445E-04	2.896E-03	4.875E-04	1.314E+00	9.556E-05	6.568E-01	

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-22: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.184E-03	6.696E-03	3.023E-05	5.090E-06	1.371E-02	9.977E-07	6.857E-03
Dichloromethane	1.519E-01	5.722E-03	1.776E-03	2.989E-04	8.054E-01	5.860E-05	4.027E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.752E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.070E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	7.375E-02	2.329E-03	8.959E-04	1.508E-04	4.064E-01	2.956E-05	2.032E-01
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	5.655E-03	3.610E-03	2.485E-05	4.183E-06	1.127E-02	8.199E-07	5.635E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND



Table B-22: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 5), M189 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. ==> 5.94						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor ==> 0.95						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	3.094E+00	1.364E+00	2.102E-02	3.539E-03	9.534E+00	6.936E-04	4.767E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:

1. ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-23: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 5.94 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Compound	Chemical Name				Total Mass of Substance Emitted (grams/item)  M	CONC	
SVOCs							
n-nitrosodimethylamine	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
phenol	1.025E-02	7.120E-03	3.806E-05	6.407E-06	1.726E-02	1.256E-06	8.632E-03
2-chlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.577E-03	5.664E-05	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
benzyl alcohol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
hexachloroethane	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-methylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
nitrobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
isophorone	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitrophenol	2.577E-03	3.660E-04	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
naphthalene	2.205E-03	1.366E-04	2.513E-05	4.231E-06	1.140E-02	8.293E-07	5.699E-03
4-chloroaniline	2.577E-02	5.605E-04	ND	ND	ND	ND	ND
hexachlorobutadiene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylnaphthalene	2.577E-03	1.694E-04	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND

Table B-23: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
2,4,5-trichlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-chloronaphthalene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitroaniline	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
dimethylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.577E-03	5.721E-05	ND	ND	ND	ND	ND
3-nitroaniline	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
2,4-dinitrophenol	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
dibenzofuran	2.577E-03	7.823E-05	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitrophenol	5.155E-03	1.316E-04	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
diethylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitroaniline	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
hexachlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
pentachlorophenol	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
di-n-butylphthalate	2.577E-03	1.080E-04	ND	ND	ND	ND	ND
butylbenzylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	8.448E-02	9.023E-04	1.015E-03	1.709E-04	4.608E-01	3.351E-05	2.303E-01
di-n-octylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND

Footnotes:

1. ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

**Table B-24: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

100 meter location		155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):		1 rounds 2 seconds 1.455E-04 (g/m³)/(g/s)	
		Net Explosive Weight (NEW) in lbs. => Number of Items = 1		SF6 Leak Rate Dilution Factor =>		5.94 0.95			
Compound	Average Adjusted Emission Rate (lb/lb NEW)								
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>		
PAHs (TO-13 Method)									
acenaphthylene	2.760E-04	1.328E-06	3.337E-06	5.618E-07	1.514E-03	1.101E-07	7.568E-04		
acenaphthene	8.752E-05	9.544E-05	ND	ND	ND	ND	ND		
fluorene	2.120E-04	6.502E-05	1.786E-06	3.007E-07	8.101E-04	5.894E-08	4.051E-04		
phenanthrene	4.889E-04	6.428E-05	5.159E-06	8.685E-07	2.340E-03	1.702E-07	1.170E-03		
anthracene	5.970E-05	4.197E-06	6.743E-07	1.135E-07	3.058E-04	2.225E-08	1.529E-04		
fluoranthene	3.011E-04	7.852E-06	3.563E-06	5.998E-07	1.616E-03	1.176E-07	8.081E-04		
pyrene	9.009E-04	6.908E-06	1.086E-05	1.829E-06	4.927E-03	3.584E-07	2.463E-03		
benzo(a)anthracene	5.147E-05	1.390E-07	6.236E-07	1.050E-07	2.829E-04	2.058E-08	1.414E-04		
chrysene	5.560E-05	3.878E-07	6.708E-07	1.129E-07	3.043E-04	2.214E-08	1.521E-04		
benzo(b)fluoranthene	1.001E-04	2.220E-07	1.213E-06	2.042E-07	5.501E-04	4.002E-08	2.751E-04		
benzo(k)fluoranthene	1.311E-04	9.826E-08	1.592E-06	2.680E-07	7.221E-04	5.254E-08	3.611E-04		
benzo(a)pyrene	1.833E-04	8.980E-08	2.226E-06	3.747E-07	1.010E-03	7.345E-08	5.048E-04		
indeno(1,2,3-cd)pyrene	2.940E-04	1.659E-07	3.570E-06	6.010E-07	1.619E-03	1.178E-07	8.096E-04		
dibenz(a,h)anthracene	9.271E-06	5.605E-08	1.126E-07	1.896E-08	5.109E-05	3.717E-09	2.554E-05		
benzo(g,h,i)perylene	7.054E-04	2.408E-07	8.566E-06	1.442E-06	3.886E-03	2.827E-07	1.943E-03		
Dioxin/Furan Data									
2378-TCDD	8.448E-09	8.000E-12	1.026E-10	1.728E-11	4.655E-08	3.387E-12	2.328E-08		
12378-PECDD	1.185E-09	9.000E-12	1.429E-11	2.405E-12	6.480E-09	4.714E-13	3.240E-09		
123478-HXCDD	6.655E-10	1.050E-11	ND	ND	ND	ND	ND		
123678-HXCDD	3.434E-09	1.700E-11	4.151E-11	6.989E-12	1.883E-08	1.370E-12	9.415E-09		
123789-HXCDD	1.261E-09	1.550E-11	1.513E-11	2.546E-12	6.861E-09	4.991E-13	3.430E-09		
1234678-HPCDD	2.972E-08	2.495E-10	3.580E-10	6.027E-11	1.624E-07	1.181E-11	8.120E-08		
OCDD	1.730E-07	1.587E-09	2.082E-09	3.505E-10	9.444E-07	6.870E-11	4.722E-07		
2378-TCDF	3.725E-09	1.100E-11	4.511E-11	7.595E-12	2.046E-08	1.489E-12	1.023E-08		
12378-PECDF	3.500E-09	1.050E-11	4.239E-11	7.137E-12	1.923E-08	1.399E-12	9.614E-09		
23478-PECDF	1.641E-09	1.550E-11	1.975E-11	3.325E-12	8.957E-09	6.516E-13	4.479E-09		
123478-HXGDF	2.772E-09	2.800E-11	3.334E-11	5.612E-12	1.512E-08	1.100E-12	7.560E-09		
123678-HXGDF	1.185E-09	1.450E-11	1.422E-11	2.394E-12	6.450E-09	4.692E-13	3.225E-09		
123789-HXGDF	3.800E-10	6.000E-12	ND	ND	ND	ND	ND		

**Table B-24: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94						
	SF6 Leak Rate Dilution Factor => 0.95						
Compound	ATC = Not Detected				Total Mass of Substance Emitted (grams/item) M	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor EF (lb/item)	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	1.157E-09	1.200E-11	1.391E-11	2.342E-12	6.310E-09	4.590E-13	3.155E-09
1234678-HPCDF	1.244E-08	7.750E-11	1.502E-10	2.529E-11	6.814E-08	4.957E-12	3.407E-08
1234789-HPCDF	5.860E-10	8.000E-12	7.022E-12	1.182E-12	3.185E-09	2.317E-13	1.593E-09
OCDF	7.895E-09	1.105E-10	9.457E-11	1.592E-11	4.290E-08	3.121E-12	2.145E-08
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	2.375E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	1.474E-01	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND

**Footnotes:**

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Table B-25: Air Modeling Output Data for Cyanide and Energetics - 100 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M		
Particulate Cyanide and HCN							
Particulate Cyanide	1.200E-01	8.000E-02	1.458E-03	2.454E-04	6.613E-01	4.811E-05	3.306E-01
Hydrogen Cyanide	1.650E+00	8.500E-02	2.005E-02	3.375E-03	9.092E+00	6.615E-04	4.546E+00
Energetics Data							
Nitrobenzene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.639E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritol tetranitrate	9.639E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.410E+01	1.016E+01	ND	ND	ND	ND	ND
Diocyl phthalate	2.410E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.205E+01	5.079E+00	ND	ND	ND	ND	ND
Footnotes:							
ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

**AIR MODELING OUTPUT DATA FOR CHARGE M3,  
FIRED FROM THE M199 CANNON, ZONE 5,  
200 METERS DOWNWIND**



Table B-26: Air Modeling Output Data for Gases, Metals, and Particulates - 200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Gases							
NH <sub>3</sub>	8.400E+00	NA	9.695E-02	1.632E-02	4.397E+01	7.151E-04	1.099E+01
CO <sub>2</sub>	1.080E+02	NA	1.246E+00	2.098E-01	5.854E+02	9.194E-03	1.413E+02
CO	2.841E+02	NA	3.278E+00	5.519E-01	1.487E+03	2.418E-02	3.717E+02
NOx (as NO)	3.936E+00	NA	4.543E-02	7.647E-03	2.060E+01	3.351E-04	5.151E+00
CH <sub>4</sub>	2.178E+00	NA	ND	ND	ND	ND	ND
SO <sub>2</sub>	5.240E-01	NA	ND	ND	ND	ND	ND
Combined Particulate							
TSP	1.122E+01	5.300E-02	1.356E-01	2.284E-02	6.153E+01	1.001E-03	1.538E+01
PM <sub>10</sub>	8.017E+00	4.233E-02	9.688E-02	1.631E-02	4.394E+01	7.146E-04	1.099E+01
PM <sub>2.5</sub>	3.180E+00	2.400E-02	3.834E-02	6.455E-03	1.739E+01	2.828E-04	4.348E+00
Metals							
Antimony	2.819E-04	4.345E-06	3.371E-06	5.676E-07	1.529E-03	2.487E-08	3.823E-04
Arsenic	6.180E-04	3.091E-06	7.470E-06	1.258E-06	3.388E-03	5.510E-08	8.471E-04
Barium	6.071E-03	3.255E-05	7.336E-05	1.235E-05	3.327E-02	5.411E-07	8.319E-03
Beryllium	7.806E-05	1.649E-06	ND	ND	ND	ND	ND
Cadmium	2.103E-04	1.649E-06	2.555E-06	4.301E-07	1.159E-03	1.885E-08	2.897E-04
Chromium	1.334E-03	7.167E-06	1.611E-05	2.713E-06	7.309E-03	1.189E-07	1.827E-03
Cobalt	1.713E-04	3.763E-06	2.035E-06	3.426E-07	9.231E-04	1.501E-08	2.309E-04
Copper	1.518E+00	1.159E-03	1.842E-02	3.102E-03	8.357E+00	1.359E-04	2.089E+00
Lead	3.036E-02	6.770E-05	3.680E-04	6.195E-05	1.689E-01	2.714E-06	4.173E-02
Manganese	7.480E-03	3.086E-05	9.050E-05	1.524E-05	4.105E-02	6.676E-07	1.026E-02
Nickel	2.494E-03	1.433E-05	3.012E-05	5.071E-06	1.366E-02	2.222E-07	3.415E-03
Selenium	2.602E-04	5.497E-06	ND	ND	ND	ND	ND
Silver	1.019E-04	1.099E-06	1.238E-06	2.084E-07	5.615E-04	9.132E-09	1.404E-04
Thallium	7.806E-05	1.613E-06	ND	ND	ND	ND	ND
Zinc	2.385E-01	1.445E-04	2.896E-03	4.875E-04	1.314E+00	2.136E-05	3.284E-01

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-27: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 5.94 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M	CONC	
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	9.184E-03	6.696E-03	3.023E-05	5.090E-06	1.371E-02	2.230E-07	3.429E-03
Dichloromethane	1.519E-01	5.722E-03	1.776E-03	2.989E-04	8.054E-01	1.310E-05	2.014E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.752E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	2.070E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	7.375E-02	2.329E-03	8.959E-04	1.508E-04	4.064E-01	6.609E-06	1.016E-01
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	5.655E-03	3.610E-03	2.485E-05	4.183E-06	1.127E-02	1.833E-07	2.818E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethane	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-27: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor EF (lb/item)	Average Adjusted Emission Factor (lb/lb NEW)			
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	3.094E+00	1.364E+00	2.102E-02	3.539E-03	9.534E+00	1.550E-04	2.384E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND
Footnotes:							
1. ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

Table B-28: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor: (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M		
SVOCs							
n-nitrosodimethylamine	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
phenol	1.025E-02	7.120E-03	3.806E-05	6.407E-06	1.726E-02	2.808E-07	4.316E-03
2-chlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.577E-03	5.664E-05	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
benzyl alcohol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
hexachloroethane	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-methylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
nitrobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
isophorone	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitrophenol	2.577E-03	3.660E-04	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
naphthalene	2.205E-03	1.366E-04	2.513E-05	4.231E-06	1.140E-02	1.854E-07	2.850E-03
4-chloroaniline	2.577E-02	5.605E-04	ND	ND	ND	ND	ND
hexachlorobutadiene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylnaphthalene	2.577E-03	1.694E-04	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND

Table B-28: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 5.94 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
2,4,5-trichlorophenol	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-chloronaphthalene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitroaniline	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
dimethylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.577E-03	5.721E-05	ND	ND	ND	ND	ND
3-nitroaniline	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
2,4-dinitrophenol	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
dibenzofuran	2.577E-03	7.823E-05	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitrophenol	5.155E-03	1.316E-04	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
diethylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitroaniline	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
hexachlorobenzene	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
pentachlorophenol	5.155E-03	1.121E-04	ND	ND	ND	ND	ND
di-n-butylphthalate	2.577E-03	1.080E-04	ND	ND	ND	ND	ND
butylbenzylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	8.448E-02	9.023E-04	1.015E-03	1.709E-04	4.606E-01	7.490E-06	1.151E-01
di-n-octylphthalate	2.577E-03	5.605E-05	ND	ND	ND	ND	ND

Footnotes:  
\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

**Table B-29: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 5.94 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
PAHs (TO-13 Method)							
acenaphthylene	2.760E-04	1.328E-06	3.337E-06	5.618E-07	1.514E-03	2.462E-08	3.784E-04
acenaphthene	8.752E-05	9.544E-05	ND	ND	ND	ND	ND
fluorene	2.120E-04	6.502E-05	1.786E-06	3.007E-07	8.101E-04	1.317E-08	2.025E-04
phenanthrene	4.889E-04	6.428E-05	5.159E-06	8.685E-07	2.340E-03	3.806E-08	5.850E-04
anthracene	5.970E-05	4.197E-06	6.743E-07	1.135E-07	3.058E-04	4.974E-09	7.646E-05
fluoranthene	3.011E-04	7.852E-06	3.563E-06	5.998E-07	1.616E-03	2.628E-08	4.040E-04
pyrene	9.009E-04	6.908E-06	1.086E-05	1.829E-06	4.927E-03	8.012E-08	1.232E-03
benzo(a)anthracene	5.147E-05	1.390E-07	6.236E-07	1.050E-07	2.829E-04	4.600E-09	7.072E-05
chrysene	5.560E-05	3.878E-07	6.708E-07	1.129E-07	3.043E-04	4.948E-09	7.607E-05
benzo(b)fluoranthene	1.001E-04	2.220E-07	1.213E-06	2.042E-07	5.501E-04	8.947E-09	1.375E-04
benzo(k)fluoranthene	1.311E-04	9.826E-08	1.592E-06	2.680E-07	7.221E-04	1.174E-08	1.805E-04
benzo(a)pyrene	1.833E-04	8.980E-08	2.226E-06	3.747E-07	1.010E-03	1.642E-08	2.524E-04
indeno(1,2,3-cd)pyrene	2.940E-04	1.659E-07	3.570E-06	6.010E-07	1.619E-03	2.633E-08	4.048E-04
dibenz(a,h)anthracene	9.271E-06	5.603E-08	1.126E-07	1.896E-08	5.109E-05	8.308E-10	1.277E-05
benzo(g,h,i)perylene	7.054E-04	2.408E-07	8.566E-06	1.442E-06	3.886E-03	6.319E-08	9.714E-04
Dioxin/Furan Data							
2378-TCDD	8.448E-09	8.000E-12	1.026E-10	1.728E-11	4.655E-08	7.571E-13	1.164E-08
12378-PECDD	1.185E-09	9.000E-12	1.429E-11	2.405E-12	6.480E-09	1.054E-13	1.620E-09
123478-HXCDD	6.655E-10	1.050E-11	ND	ND	ND	ND	ND
123678-HXCDD	3.434E-09	1.700E-11	4.151E-11	6.989E-12	1.883E-08	3.062E-13	4.707E-09
123789-HXCDD	1.261E-09	1.550E-11	1.513E-11	2.546E-12	6.861E-09	1.116E-13	1.715E-09
1234678-HPCDD	2.972E-08	2.495E-10	3.580E-10	6.027E-11	1.624E-07	2.641E-12	4.060E-08
OCDD	1.730E-07	1.587E-09	2.082E-09	3.505E-10	9.444E-07	1.536E-11	2.361E-07
2378-TCDF	3.725E-09	1.100E-11	4.511E-11	7.595E-12	2.046E-08	3.328E-13	5.116E-09
12378-PECDF	3.500E-09	1.050E-11	4.239E-11	7.137E-12	1.923E-08	3.127E-13	4.807E-09
23478-HXCDF	1.641E-09	1.550E-11	1.975E-11	3.325E-12	8.957E-09	1.457E-13	2.239E-09
123478-HXCDF	2.772E-09	2.800E-11	3.334E-11	5.612E-12	1.512E-08	2.459E-13	3.780E-09
123678-HXCDF	1.185E-09	1.450E-11	1.422E-11	2.394E-12	6.450E-09	1.049E-13	1.613E-09
123789-HXCDF	3.800E-10	6.000E-12	ND	ND	ND	ND	ND



**Table B-29: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 5.94 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	1.157E-09	1.200E-11	1.391E-11	2.342E-12	6.310E-09	1.026E-13	1.577E-09
1234678-HPCDF	1.244E-08	7.750E-11	1.502E-10	2.529E-11	6.814E-08	1.108E-12	1.703E-08
1234789-HPCDF	5.860E-10	8.000E-12	7.022E-12	1.182E-12	3.185E-09	5.180E-14	7.963E-10
OCDF	7.895E-09	1.105E-10	9.457E-11	1.592E-11	4.290E-08	6.976E-13	1.072E-08
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	2.375E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	1.474E-01	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-30: Air Modeling Output Data for Cyanide and Energetics - 200 meter location

Compound	155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 5.94 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.95						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Particulate Cyanide and HCN							
Particulate Cyanide	1.200E-01	8.000E-02	1.458E-03	2.454E-04	6.613E-01	1.075E-05	1.653E-01
Hydrogen Cyanide	1.650E+00	8.500E-02	2.005E-02	3.375E-03	9.092E+00	1.479E-04	2.273E+00
Energetics Data							
Nitrobenzene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.819E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.639E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritol tetranitrate	9.639E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.410E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.410E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.205E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							



**AIR MODELING OUTPUT DATA FOR CHARGE M3A1,  
FIRED FROM THE M199 CANNON, ZONE 3,  
100 METERS DOWNWIND**

Table B-31: Air Modeling Output Data for Gases, Metals, and Particulates - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
<b>Gases</b>							
NH3	3.780E+00	NA	4.363E-02	1.246E-02	1.979E+01	9.249E-04	9.894E+00
CO2	6.480E+01	NA	7.479E-01	2.137E-01	3.392E+02	1.586E-02	1.696E+02
CO	1.725E+02	NA	1.991E+00	5.688E-01	9.030E+02	4.221E-02	4.515E+02
NOx (as NO)	2.460E-01	NA	ND	ND	ND	ND	ND
CH4	2.178E+00	NA	ND	ND	ND	ND	ND
SO2	5.240E-01	NA	ND	ND	ND	ND	ND
<b>Combined Particulate</b>							
TSP	5.189E+00	5.300E-02	6.374E-02	1.821E-02	2.891E+01	1.351E-03	1.446E+01
PM10	3.692E+00	4.233E-02	4.529E-02	1.294E-02	2.054E+01	9.601E-04	1.027E+01
PM2.5	1.999E+00	2.400E-02	2.451E-02	7.003E-03	1.112E+01	5.196E-04	5.559E+00
<b>Metals</b>							
Antimony	1.840E-04	4.345E-06	ND	ND	ND	ND	ND
Arsenic	1.193E-04	3.091E-06	1.442E-06	4.121E-07	6.542E-04	3.058E-08	3.271E-04
Barium	2.518E-03	3.255E-05	3.085E-05	8.814E-06	1.399E-02	6.540E-07	6.996E-03
Beryllium	7.885E-05	1.649E-06	ND	ND	ND	ND	ND
Cadmium	8.713E-05	1.649E-06	1.081E-06	3.089E-07	4.904E-04	2.292E-08	2.452E-04
Chromium	7.007E-04	7.167E-06	8.606E-06	2.459E-06	3.904E-03	1.825E-07	1.952E-03
Cobalt	6.461E-05	3.763E-06	7.551E-07	2.157E-07	3.425E-04	1.601E-08	1.713E-04
Copper	6.788E-01	1.159E-03	8.409E-03	2.403E-03	3.814E+00	1.783E-04	1.907E+00
Lead	2.003E-02	6.770E-05	2.478E-04	7.079E-05	1.124E-01	5.253E-06	5.619E-02
Manganese	2.244E-03	3.086E-05	2.747E-05	7.848E-06	1.246E-02	5.823E-07	6.230E-03
Nickel	1.226E-03	1.433E-05	1.504E-05	4.297E-06	6.821E-03	3.188E-07	3.411E-03
Selenium	2.628E-04	5.497E-06	ND	ND	ND	ND	ND
Silver	5.445E-05	1.099E-06	6.758E-07	1.931E-07	3.065E-04	1.433E-08	1.533E-04
Thallium	7.885E-05	1.613E-06	ND	ND	ND	ND	ND
Zinc	1.456E-01	1.445E-04	1.805E-03	5.159E-04	8.189E-01	3.828E-05	4.095E-01

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-32: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (l): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³)  CONC	Substance Emission Rate for One Round (g/sec)  ER₁
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.107E-03	6.696E-03	2.992E-05	8.549E-06	1.357E-02	6.343E-07	6.786E-03
Dichloromethane	2.102E-01	5.722E-03	2.538E-03	7.251E-04	1.151E+00	5.381E-05	5.756E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.799E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	3.272E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	5.900E-02	2.329E-03	7.322E-04	2.092E-04	3.321E-01	1.552E-05	1.661E-01
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethane	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	6.492E-03	3.610E-03	3.577E-05	1.022E-05	1.622E-02	7.583E-07	8.112E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-32: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.222E+00	1.364E+00	1.065E-02	3.043E-03	4.831E+00	2.258E-04	2.415E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND
Footnotes:							
¹ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

Table B-33: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.93						
Compound							
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
SVOCs							
n-nitrosodimethylamine	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
phenol	2.100E-02	7.120E-03	1.722E-04	4.921E-05	7.812E-02	3.651E-06	3.906E-02
2-chlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.829E-03	5.664E-05	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
benzyl alcohol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
hexachloroethane	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-methylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
nitrobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
isophorone	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitrophenol	2.829E-03	3.660E-04	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
naphthalene	3.112E-03	1.366E-04	3.693E-05	1.055E-05	1.675E-02	7.828E-07	8.374E-03
4-chloroaniline	2.829E-02	5.605E-04	ND	ND	ND	ND	ND
hexachlorobutadiene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylnaphthalene	2.829E-03	1.694E-04	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND

Table B-33: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):		1 rounds 2 seconds (g/m <sup>3</sup> )/(g/s)	
	Net Explosive Weight (NEW) in lbs. => Number of Items = 1				3.50		9.348E-05	
	SF6 Leak Rate Dilution Factor =>				0.93			
Compound	Average Adjusted Emission Factor (lb/lb NEW)				Average Adjusted Emission Factor (lb/lb NEW)		Average Modeled Concentration for One Round (grams/m <sup>3</sup> )	
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/lb NEW)	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>	
2,4,5-trichlorophenol	2.829E-03	5.605E-05	ND	ND	ND		ND	
2-chloronaphthalene	2.829E-03	5.605E-05	ND	ND	ND		ND	
2-nitroaniline	2.829E-03	5.605E-05	ND	ND	ND		ND	
dimethylphthalate	2.829E-03	5.605E-05	ND	ND	ND		ND	
2,6-dinitrotoluene	2.829E-03	5.721E-05	ND	ND	ND		ND	
3-nitroaniline	5.658E-03	1.121E-04	ND	ND	ND		ND	
2,4-dinitrophenol	5.658E-03	1.121E-04	ND	ND	ND		ND	
dibenzofuran	2.829E-03	7.823E-05	ND	ND	ND		ND	
2,4-dinitrotoluene	2.829E-03	5.605E-05	ND	ND	ND		ND	
4-nitrophenol	5.658E-03	1.316E-04	ND	ND	ND		ND	
4-chlorophenyl-phenylether	2.829E-03	5.605E-05	ND	ND	ND		ND	
diethylphthalate	2.829E-03	5.605E-05	ND	ND	ND		ND	
4-nitroaniline	5.658E-03	1.121E-04	ND	ND	ND		ND	
4,6-dinitro-2-methylphenol	5.658E-03	1.121E-04	ND	ND	ND		ND	
n-nitrosodiphenylamine(1)	2.829E-03	5.605E-05	ND	ND	ND		ND	
4-bromophenyl-phenylether	2.829E-03	5.605E-05	ND	ND	ND		ND	
hexachlorobenzene	2.829E-03	5.605E-05	ND	ND	ND		ND	
pentachlorophenol	5.658E-03	1.121E-04	ND	ND	ND		ND	
di-n-butylphthalate	2.829E-03	1.080E-04	ND	ND	ND		ND	
butylbenzylphthalate	2.829E-03	5.605E-05	ND	ND	ND		ND	
bis(2-ethylhexyl)phthalate	2.829E-03	5.605E-05	ND	ND	ND		ND	
di-n-octylphthalate	2.829E-03	5.605E-05	ND	ND	ND		ND	

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected



Table B-34: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases  
100 meter location

100 meter location	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540					No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER₁
	Net Explosive Weight (NEW) In lbs. => 3.50							
	SF6 Leak Rate Dilution Factor => 0.93							
Compound	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M			
PAHs (TO-13 Method)								
acenaphthylene	4.910E-04	1.328E-06	6.076E-06	1.736E-06	2.756E-03	1.288E-07	1.378E-03	
acenaphthene	1.507E-04	9.544E-05	6.854E-07	1.958E-07	3.109E-04	1.453E-08	1.554E-04	
fluorene	2.571E-04	6.502E-05	2.383E-06	6.810E-07	1.081E-03	5.053E-08	5.405E-04	
phenanthrene	3.933E-04	6.428E-05	4.083E-06	1.167E-06	1.852E-03	8.657E-08	9.261E-04	
anthracene	4.472E-05	4.197E-06	5.028E-07	1.437E-07	2.281E-04	1.066E-08	1.140E-04	
fluoranthene	1.899E-04	7.852E-06	2.259E-06	6.455E-07	1.025E-03	4.790E-08	5.124E-04	
pyrene	4.444E-04	6.908E-06	5.429E-06	1.551E-06	2.463E-03	1.151E-07	1.231E-03	
benzo(a)anthracene	2.472E-05	1.390E-07	3.051E-07	8.716E-08	1.384E-04	6.468E-09	6.919E-05	
chrysene	3.038E-05	3.878E-07	3.722E-07	1.063E-07	1.688E-04	7.891E-09	8.441E-05	
benzo(b)fluoranthene	8.760E-05	2.220E-07	1.084E-06	3.098E-07	4.919E-04	2.299E-08	2.459E-04	
benzo(k)fluoranthene	5.658E-05	9.826E-08	7.010E-07	2.003E-07	3.179E-04	1.486E-08	1.590E-04	
benzo(a)pyrene	1.118E-04	8.980E-08	1.386E-06	3.960E-07	6.287E-04	2.939E-08	3.144E-04	
indeno(1,2,3-cd)pyrene	1.997E-04	1.659E-07	2.476E-06	7.074E-07	1.123E-03	5.249E-08	5.615E-04	
dibenz(a,h)anthracene	6.252E-06	5.605E-08	7.758E-08	2.217E-08	3.519E-05	1.645E-09	1.760E-05	
benzo(g,h,i)perylene	3.906E-04	2.408E-07	4.844E-06	1.384E-06	2.197E-03	1.027E-07	1.099E-03	
Dioxin/Furan Data								
2378-TCDD	3.445E-10	8.000E-12	ND	ND	ND	ND	ND	
12378-PECDD	3.440E-10	9.000E-12	4.157E-12	1.188E-12	1.886E-09	8.814E-14	9.429E-10	
123478-HXCDD	4.715E-10	1.050E-11	ND	ND	ND	ND	ND	
123678-HXCDD	9.690E-10	1.700E-11	1.181E-11	3.375E-12	5.359E-09	2.505E-13	2.679E-09	
123789-HXCDD	1.086E-09	1.550E-11	1.328E-11	3.796E-12	6.026E-09	2.816E-13	3.013E-09	
1234678-HPCDD	9.763E-09	2.495E-10	1.181E-10	3.373E-11	5.355E-08	2.503E-12	2.677E-08	
OCDD	3.881E-08	1.587E-09	4.619E-10	1.320E-10	2.095E-07	9.793E-12	1.048E-07	
2378-TCDF	5.095E-10	1.100E-11	ND	ND	ND	ND	ND	
12378-PECDF	2.885E-10	1.050E-11	ND	ND	ND	ND	ND	
23478-PECDF	1.595E-10	1.550E-11	ND	ND	ND	ND	ND	
123478-HXCDF	1.980E-10	2.800E-11	2.110E-12	6.028E-13	9.569E-10	4.473E-14	4.785E-10	
123678-HXCDF	1.525E-10	1.450E-11	ND	ND	ND	ND	ND	
123789-HXCDF	2.730E-10	6.000E-12	ND	ND	ND	ND	ND	



**Table B-34: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	2.255E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	7.025E-10	7.750E-11	7.756E-12	2.216E-12	3.518E-09	1.644E-13	1.759E-09
1234789-HPCDF	2.635E-10	8.000E-12	ND	ND	ND	ND	ND
OCDF	1.347E-09	1.105E-10	1.534E-11	4.384E-12	6.960E-09	3.253E-13	3.480E-09
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	2.375E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	9.828E-02	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND

Footnotes:

1 ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-35: Air Modeling Output Data for Cyanide and Energetics - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50						
	SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M		
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	3.800E-01	8.500E-02	4.716E-03	1.347E-03	2.139E+00	9.998E-05	1.070E+00
Energetics Data							
Nitrobenzene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.481E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritoltetranitrate	9.481E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.370E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.370E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.185E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
1. ATC = Aberdeen Test Center (for additional Information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

**AIR MODELING OUTPUT DATA FOR CHARGE M3A1,  
FIRED FROM THE M199 CANNON, ZONE 3,  
200 METERS DOWNWIND**

Table B-36: Air Modeling Output Data for Gases, Metals, and Particulates - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER₁
	Net Explosive Weight (NEW) in lbs. => 3.50						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor ==> 0.93						
Compound	Average Adjusted Emission Rate						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M		
Gases							
NH3	3.780E+00	NA	4.363E-02	1.246E-02	1.979E+01	2.391E-04	4.947E+00
CO2	6.480E+01	NA	7.479E-01	2.137E-01	3.392E+02	4.099E-03	8.481E+01
CO	1.725E+02	NA	1.991E+00	5.688E-01	9.030E+02	1.091E-02	2.258E+02
NOx (as NO)	2.460E-01	NA	ND	ND	ND	ND	ND
CH4	2.178E+00	NA	ND	ND	ND	ND	ND
SO2	5.240E-01	NA	ND	ND	ND	ND	ND
Combined Particulate							
TSP	5.189E+00	5.300E-02	6.374E-02	1.821E-02	2.891E+01	3.493E-04	7.228E+00
PM10	3.692E+00	4.233E-02	4.529E-02	1.294E-02	2.054E+01	2.482E-04	5.135E+00
PM2.5	1.999E+00	2.400E-02	2.451E-02	7.003E-03	1.112E+01	1.343E-04	2.779E+00
Metals							
Antimony	1.840E-04	4.345E-06	ND	ND	ND	ND	ND
Arsenic	1.193E-04	3.091E-06	1.442E-06	4.121E-07	6.542E-04	7.904E-09	1.635E-04
Barium	2.518E-03	3.255E-05	3.085E-05	8.814E-06	1.399E-02	1.691E-07	3.498E-03
Beryllium	7.885E-05	1.649E-06	ND	ND	ND	ND	ND
Cadmium	8.713E-05	1.649E-06	1.081E-06	3.089E-07	4.904E-04	5.926E-09	1.226E-04
Chromium	7.007E-04	7.167E-06	8.606E-06	2.459E-06	3.904E-03	4.717E-08	9.760E-04
Cobalt	6.461E-05	3.763E-06	7.551E-07	2.157E-07	3.425E-04	4.138E-09	8.563E-05
Copper	6.788E-01	1.159E-03	8.409E-03	2.403E-03	3.814E+00	4.609E-05	9.536E-01
Lead	2.003E-02	6.770E-05	2.478E-04	7.079E-05	1.124E-01	1.356E-06	2.810E-02
Manganese	2.244E-03	3.086E-05	2.747E-05	7.848E-06	1.246E-02	1.505E-07	3.115E-03
Nickel	1.226E-03	1.433E-05	1.504E-05	4.297E-06	6.821E-03	8.242E-08	1.705E-03
Selenium	2.628E-04	5.497E-06	ND	ND	ND	ND	ND
Silver	5.445E-05	1.099E-06	6.758E-07	1.931E-07	3.065E-04	3.704E-09	7.663E-05
Thallium	7.885E-05	1.613E-06	ND	ND	ND	ND	ND
Zinc	1.456E-01	1.445E-04	1.805E-03	5.159E-04	8.189E-01	9.895E-06	2.047E-01

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-37: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled for Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethene	9.107E-03	6.696E-03	2.992E-05	8.549E-06	1.357E-02	1.640E-07	3.393E-03
Dichloromethane	2.102E-01	5.722E-03	2.538E-03	7.251E-04	1.151E+00	1.391E-05	2.878E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.799E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	3.272E-02	1.095E-01	ND	ND	ND	ND	ND
Benzene	5.900E-02	2.329E-03	7.322E-04	2.092E-04	3.321E-01	4.013E-06	8.303E-02
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	6.492E-03	3.610E-03	3.577E-05	1.022E-05	1.622E-02	1.960E-07	4.056E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-37: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50						
	SF6 Leak Rate Dilution Factor => 0.93						
Compound	SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.222E+00	1.364E+00	1.065E-02	3.043E-03	4.831E+00	5.837E-05	1.208E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-38: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (t) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor EF	Average Adjusted Emission Factor (lb/lb NEW)			
Average Emission Factor (EF) = 1.722E-04							
SVOCs							
n-nitrosodimethylamine	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
phenol	2.100E-02	7.120E-03	1.722E-04	4.921E-05	7.812E-02	9.439E-07	1.953E-02
2-chlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.829E-03	5.664E-05	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
benzyl alcohol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
hexachloroethane	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-methylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
nitrobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
isophorone	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitrophenol	2.829E-03	3.660E-04	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
naphthalene	3.112E-03	1.366E-04	3.693E-05	1.055E-05	1.675E-02	2.024E-07	4.187E-03
4-chloroaniline	2.829E-02	5.605E-04	ND	ND	ND	ND	ND
hexachlorobutadiene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-methylnaphthalene	2.829E-03	1.694E-04	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND

Table B-38: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
2,4,5-trichlorophenol	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-chloronaphthalene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2-nitroaniline	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
dimethylphthalate	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.829E-03	5.721E-05	ND	ND	ND	ND	ND
3-nitroaniline	5.658E-03	1.121E-04	ND	ND	ND	ND	ND
2,4-dinitrophenol	5.658E-03	1.121E-04	ND	ND	ND	ND	ND
dibenzofuran	2.829E-03	7.823E-05	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitrophenol	5.658E-03	1.316E-04	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
diethylphthalate	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-nitroaniline	5.658E-03	1.121E-04	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	5.658E-03	1.121E-04	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
hexachlorobenzene	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
pentachlorophenol	5.658E-03	1.121E-04	ND	ND	ND	ND	ND
di-n-butylphthalate	2.829E-03	1.080E-04	ND	ND	ND	ND	ND
butylbenzylphthalate	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	2.829E-03	5.605E-05	ND	ND	ND	ND	ND
di-n-octylphthalate	2.829E-03	5.605E-05	ND	ND	ND	ND	ND

Footnotes:  
\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

**Table B-39: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => Number of Items = 1 SF6 Leak Rate Dilution Factor =>						
	3.50 0.93						
Compound	PAHs (TO-13 Method)						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
acenaphthylene	4.910E-04	1.328E-06	6.076E-06	1.736E-06	2.756E-03	3.330E-08	6.890E-04
acenaphthene	1.507E-04	9.544E-05	6.854E-07	1.958E-07	3.109E-04	3.756E-09	7.772E-05
fluorene	2.571E-04	6.502E-05	2.383E-06	6.810E-07	1.081E-03	1.306E-08	2.703E-04
phenanthrene	3.933E-04	6.428E-05	4.083E-06	1.167E-06	1.852E-03	2.238E-08	4.630E-04
anthracene	4.472E-05	4.197E-06	5.028E-07	1.437E-07	2.281E-04	2.756E-09	5.702E-05
fluoranthene	1.899E-04	7.852E-06	2.259E-06	6.455E-07	1.025E-03	1.238E-08	2.562E-04
pyrene	4.444E-04	6.908E-06	5.429E-06	1.551E-06	2.463E-03	2.975E-08	6.157E-04
benzo(a)anthracene	2.472E-05	1.390E-07	3.051E-07	8.716E-08	1.384E-04	1.672E-09	3.459E-05
chrysene	3.038E-05	3.878E-07	3.722E-07	1.063E-07	1.688E-04	2.040E-09	4.221E-05
benzo(b)fluoranthene	8.760E-05	2.220E-07	1.084E-06	3.098E-07	4.919E-04	5.943E-09	1.230E-04
benzo(k)fluoranthene	5.658E-05	9.826E-08	7.010E-07	2.003E-07	3.179E-04	3.842E-09	7.949E-05
benzo(a)pyrene	1.118E-04	8.980E-08	1.386E-06	3.960E-07	6.287E-04	7.597E-09	1.572E-04
indeno(1,2,3-cd)pyrene	1.997E-04	1.659E-07	2.476E-06	7.074E-07	1.123E-03	1.357E-08	2.807E-04
dibenz(a,h)anthracene	6.252E-06	5.605E-08	7.758E-08	2.217E-08	3.519E-05	4.252E-10	8.798E-06
benzo(g,h,i)perylene	3.906E-04	2.408E-07	4.844E-06	1.384E-06	2.197E-03	2.655E-08	5.493E-04
Dioxin/Furan Data							
2378-TCDD	3.445E-10	8.000E-12	ND	ND	ND	ND	ND
12378-PECDD	3.440E-10	9.000E-12	4.157E-12	1.188E-12	1.886E-09	2.278E-14	4.714E-10
123478-HXCDD	4.715E-10	1.050E-11	ND	ND	ND	ND	ND
123678-HXCDD	9.690E-10	1.700E-11	1.181E-11	3.375E-12	5.359E-09	6.475E-14	1.340E-09
123789-HXCDD	1.086E-09	1.550E-11	1.328E-11	3.796E-12	6.026E-09	7.281E-14	1.506E-09
1234678-HPCDD	9.763E-09	2.495E-10	1.181E-10	3.373E-11	5.355E-08	6.470E-13	1.339E-08
OCDD	3.881E-08	1.587E-09	4.619E-10	1.320E-10	2.095E-07	2.532E-12	5.238E-08
2378-TCDF	5.095E-10	1.100E-11	ND	ND	ND	ND	ND
12378-PECDF	2.885E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	1.595E-10	1.550E-11	ND	ND	ND	ND	ND
123478-HXCDF	1.980E-10	2.800E-11	2.110E-12	6.028E-13	9.569E-10	1.156E-14	2.392E-10
123678-HXCDF	1.525E-10	1.450E-11	ND	ND	ND	ND	ND
123789-HXCDF	2.730E-10	6.000E-12	ND	ND	ND	ND	ND

**Table B-39: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.93						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	2.255E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	7.025E-10	7.750E-11	7.756E-12	2.216E-12	3.518E-09	4.251E-14	8.795E-10
1234789-HPCDF	2.635E-10	8.000E-12	ND	ND	ND	ND	ND
OCDF	1.347E-09	1.105E-10	1.534E-11	4.384E-12	6.960E-09	8.410E-14	1.740E-09
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	2.375E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	9.828E-02	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND

Footnotes:

<sup>1</sup>ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-40: Air Modeling Output Data for Cyanide and Energetics - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				No. of rounds (I) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.93						
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M		
	ATC Firing Point Emissions Results						
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	3.800E-01	8.500E-02	4.716E-03	1.347E-03	2.139E+00	2.584E-05	5.348E-01
Energetics Data							
Nitrobenzene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.740E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.481E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritoltrinitrate	9.481E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.370E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.370E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.185E+01	5.078E+00	ND	ND	ND	ND	ND
Footnotes:							
*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							

**AIR MODELING OUTPUT DATA FOR CHARGE M3A1,  
FIRED FROM THE M284 CANNON, ZONE 3,  
100 METERS DOWNWIND**



Table B-41: Air Modelling Output Data for Gases, Metals, and Particulates - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (l): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.932						
Compound	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M		
<b>Gases</b>							
NH3	5.530E+00	NA	6.382E-02	1.824E-02	2.895E+01	1.353E-03	1.447E+01
CO2	6.120E+01	NA	7.063E-01	2.018E-01	3.204E+02	1.497E-02	1.602E+02
CO	1.656E+02	NA	1.911E+00	5.461E-01	8.669E+02	4.052E-02	4.335E+02
NOx (as NO)	2.962E+00	NA	3.407E-02	9.734E-03	1.545E+01	7.223E-04	7.727E+00
CH4	2.178E+00	NA	ND	ND	ND	ND	ND
SO2	5.240E-01	NA	ND	ND	ND	ND	ND
<b>Combined Particulate</b>							
TSP	5.510E+00	5.300E-02	6.758E-02	1.931E-02	3.065E+01	1.433E-03	1.533E+01
PM10	4.875E+00	4.233E-02	5.984E-02	1.710E-02	2.714E+01	1.269E-03	1.357E+01
PM2.5	2.731E+00	2.400E-02	3.352E-02	9.578E-03	1.520E+01	7.107E-04	7.602E+00
<b>Metals</b>							
Antimony	1.872E-04	4.345E-06	ND	ND	ND	ND	ND
Arsenic	1.895E-04	3.091E-06	2.308E-06	6.594E-07	1.047E-03	4.893E-08	5.234E-04
Barium	4.346E-03	3.255E-05	5.342E-05	1.526E-05	2.423E-02	1.133E-06	1.212E-02
Beryllium	8.024E-05	1.649E-06	ND	ND	ND	ND	ND
Cadmium	8.024E-05	1.649E-06	ND	ND	ND	ND	ND
Chromium	4.012E-04	7.167E-06	4.879E-06	1.394E-06	2.213E-03	1.034E-07	1.107E-03
Cobalt	6.352E-05	3.763E-06	7.400E-07	2.114E-07	3.357E-04	1.569E-08	1.678E-04
Copper	2.129E-01	1.159E-03	2.622E-03	7.490E-04	1.189E+00	5.558E-05	5.946E-01
Lead	1.527E-02	6.770E-05	1.882E-04	5.378E-05	8.538E-02	3.991E-06	4.269E-02
Manganese	1.337E-03	3.086E-05	1.618E-05	4.622E-06	7.338E-03	3.430E-07	3.669E-03
Nickel	6.241E-04	1.433E-05	7.551E-06	2.157E-06	3.425E-03	1.601E-07	1.712E-03
Selenium	2.675E-04	5.497E-06	ND	ND	ND	ND	ND
Silver	5.349E-05	1.099E-06	ND	ND	ND	ND	ND
Thallium	8.024E-05	1.613E-06	ND	ND	ND	ND	ND
Zinc	4.012E-02	1.445E-04	4.950E-04	1.414E-04	2.245E-01	1.049E-05	1.123E-01

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-42: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.932						
Compound	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1				Total Mass of Substance Emitted (grams/item) M	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
VOCs							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	9.135E-03	6.696E-03	3.021E-05	8.632E-06	1.370E-02	1.656E-07	3.426E-03
Dichloromethane	1.697E-01	5.722E-03	2.031E-03	5.803E-04	9.213E-01	1.113E-05	2.303E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.767E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	1.257E-01	1.095E-01	2.011E-04	5.745E-05	9.121E-02	1.102E-06	2.280E-02
Benzene	5.461E-02	2.329E-03	6.763E-04	1.932E-04	3.068E-01	3.706E-06	7.669E-02
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	7.167E-03	3.610E-03	4.404E-05	1.258E-05	1.998E-02	2.414E-07	4.994E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethene	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-42: Air Modeling Output Data for Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50						
	SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M		
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.130E+00	1.364E+00	9.490E-03	2.712E-03	4.305E+00	5.201E-05	1.076E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND

Footnotes:  
1 ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-43: Air Modelling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
SVOCs							
n-nitrosodimethylamine	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
phenol	2.642E-02	1.712E-02	1.151E-04	3.289E-05	5.221E-02	6.309E-07	1.305E-02
2-chlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
benzyl alcohol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-methylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
hexachloroethane	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-methylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
nitrobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
isophorone	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-nitrophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
naphthalene	3.145E-03	2.446E-03	3.894E-05	1.113E-05	1.766E-02	2.134E-07	4.416E-03
4-chloroaniline	2.402E-02	2.446E-02	ND	ND	ND	ND	ND
hexachlorobutadiene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-methylnaphthalene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND

Table B-43: Air Modeling Output Data for Semi-Volatile Organic Compounds - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
2,4,5-trichlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-chloronaphthalene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-nitroaniline	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
dimethylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
3-nitroaniline	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
2,4-dinitrophenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
dibenzofuran	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-nitrophenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
diethylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-nitroaniline	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
hexachlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
pentachlorophenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
di-n-butylphthalate	5.873E-03	2.446E-03	7.273E-05	2.078E-05	3.299E-02	3.986E-07	8.248E-03
butylbenzylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	7.191E-02	1.027E-01	ND	ND	ND	ND	ND
di-n-octylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected



Table B-44: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases  
100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
PAHs (TO-13 Method)							
acenaphthylene	5.329E-04	1.027E-05	6.472E-06	1.849E-06	2.936E-03	3.547E-08	7.339E-04
acenaphthene	1.682E-04	3.180E-04	ND	ND	ND	ND	ND
fluorene	2.490E-04	2.275E-04	2.658E-07	7.595E-08	1.206E-04	1.457E-09	3.015E-05
phenanthrene	3.516E-04	1.932E-04	1.961E-06	5.604E-07	8.897E-04	1.075E-08	2.224E-04
anthracene	5.198E-05	7.094E-06	5.558E-07	1.588E-07	2.521E-04	3.046E-09	6.303E-05
fluoranthene	1.712E-04	1.614E-05	1.920E-06	5.486E-07	8.709E-04	1.052E-08	2.177E-04
pyrene	3.254E-04	1.663E-05	3.823E-06	1.092E-06	1.734E-03	2.095E-08	4.335E-04
benzo(a)anthracene	2.751E-05	2.446E-06	3.406E-07	9.732E-08	1.545E-04	1.867E-09	3.863E-05
chrysene	2.751E-05	2.446E-06	3.406E-07	9.732E-08	1.545E-04	1.867E-09	3.863E-05
benzo(b)fluoranthene	7.178E-05	2.446E-06	8.889E-07	2.540E-07	4.032E-04	4.872E-09	1.008E-04
benzo(k)fluoranthene	4.740E-05	2.446E-06	5.870E-07	1.677E-07	2.662E-04	3.217E-09	6.656E-05
benzo(a)pyrene	1.089E-04	2.446E-06	1.349E-06	3.854E-07	6.119E-04	7.393E-09	1.530E-04
indeno(1,2,3-cd)pyrene	1.530E-04	2.935E-06	1.858E-06	5.309E-07	8.428E-04	1.018E-08	2.107E-04
dibenz(a,h)anthracene	5.148E-06	2.446E-06	6.375E-08	1.821E-08	2.892E-05	3.494E-10	7.229E-06
benzo(g,h,i)perylene	2.715E-04	5.626E-06	3.292E-06	9.406E-07	1.493E-03	1.804E-08	3.733E-04
Dioxin/Furan Data							
2378-TCDD	4.245E-10	8.000E-12	ND	ND	ND	ND	ND
12378-PECDD	3.225E-10	9.000E-12	ND	ND	ND	ND	ND
123478-HXCDD	5.490E-10	1.050E-11	ND	ND	ND	ND	ND
123678-HXCDD	7.690E-10	1.700E-11	9.312E-12	2.661E-12	4.224E-09	5.104E-14	1.056E-09
123789-HXCDD	8.705E-10	1.550E-11	1.059E-11	3.025E-12	4.802E-09	5.803E-14	1.201E-09
1234678-HPCDD	9.178E-09	2.495E-10	1.106E-10	3.159E-11	5.015E-08	6.059E-13	1.254E-08
OCDD	4.458E-08	1.587E-09	5.324E-10	1.521E-10	2.415E-07	2.918E-12	6.037E-08
2378-TCDF	1.230E-10	1.100E-11	ND	ND	ND	ND	ND
12378-PECDF	3.375E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	1.950E-10	1.550E-11	ND	ND	ND	ND	ND
123478-HXCDF	1.840E-10	2.800E-11	ND	ND	ND	ND	ND
123678-HXCDF	1.795E-10	1.450E-11	ND	ND	ND	ND	ND
123789-HXCDF	3.220E-10	6.000E-12	ND	ND	ND	ND	ND



**Table B-44: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (l): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>i</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
234678-HXCDF	2.640E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	7.080E-10	7.750E-11	7.808E-12	2.231E-12	3.541E-09	4.279E-14	8.854E-10
1234789-HPCDF	3.755E-10	8.000E-12	ND	ND	ND	ND	ND
OCDF	1.436E-09	1.105E-10	1.641E-11	4.690E-12	7.445E-09	8.996E-14	1.861E-09
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	3.563E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	9.828E-02	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	2.400E-01	2.200E-01	2.477E-04	7.076E-05	1.123E-01	1.357E-06	2.808E-02
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	2.950E-01	1.400E-01	3.653E-03	1.044E-03	1.657E+00	2.002E-05	4.142E-01

Footnotes:

ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-45: Air Modelling Output Data for Cyanide and Energetics - 100 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.932						
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Energetics Data						
Particulate Cyanide and HCN							
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND	ND
Hydrogen Cyanide	9.000E-01	8.500E-02	1.114E-02	3.184E-03	5.055E+00	6.108E-05	1.264E+00
Energetics Data							
Nitrobenzene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
2-Nitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
3-Nitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
4-Nitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
Nitroglycerine	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
1,3-Dinitrobenzene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
RDX	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
Tetryl	4.713E-01	2.031E-01	ND	ND	ND	ND	ND
HMX	9.426E-01	4.062E-01	ND	ND	ND	ND	ND
Pentaerythritol tetranitrate	9.426E-01	4.062E-01	ND	ND	ND	ND	ND
Dibutyl phthalate	2.357E+01	1.016E+01	ND	ND	ND	ND	ND
Diethyl phthalate	2.357E+01	1.016E+01	ND	ND	ND	ND	ND
Diphenylamine	1.178E+01	5.078E+00	ND	ND	ND	ND	ND

Footnotes:  
\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

1 ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

**AIR MODELING OUTPUT DATA FOR CHARGE M3A1,  
FIRED FROM THE M284 CANNON, ZONE 3,  
200 METERS DOWNWIND**

Table B-46: Air Modeling Output Data for Gases, Metals, and Particulates - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):		Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932				Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Total Mass of Substance Emitted (grams/item)  M	
	Average Adjusted Emission Factor (lb/lb NEW)						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Average Adjusted Emission Factor							
Gases							
NH3	5.530E+00	NA	6.382E-02	1.824E-02	2.895E+01	3.498E-04	7.237E+00
CO2	6.120E+01	NA	7.063E-01	2.018E-01	3.204E+02	3.871E-03	8.010E+01
CO	1.656E+02	NA	1.911E+00	5.461E-01	8.669E+02	1.047E-02	2.167E+02
NOx (as NO)	2.952E+00	NA	3.407E-02	9.734E-03	1.545E+01	1.867E-04	3.863E+00
CH4	2.178E+00	NA	ND	ND	ND	ND	ND
SO2	5.240E-01	NA	ND	ND	ND	ND	ND
Combined Particulate							
TSP	5.510E+00	5.300E-02	6.758E-02	1.931E-02	3.065E+01	3.703E-04	7.663E+00
PM10	4.875E+00	4.233E-02	5.984E-02	1.710E-02	2.714E+01	3.279E-04	6.785E+00
PM2.5	2.731E+00	2.400E-02	3.352E-02	9.578E-03	1.520E+01	1.837E-04	3.801E+00
Metals							
Antimony	1.872E-04	4.345E-06	ND	ND	ND	ND	ND
Arsenic	1.895E-04	3.091E-06	2.308E-06	6.594E-07	1.047E-03	1.269E-08	2.617E-04
Barium	4.346E-03	3.255E-05	5.342E-05	1.526E-05	2.423E-02	2.928E-07	6.058E-03
Beryllium	8.024E-05	1.649E-06	ND	ND	ND	ND	ND
Cadmium	8.024E-05	1.649E-06	ND	ND	ND	ND	ND
Chromium	4.012E-04	7.167E-06	4.879E-06	1.394E-06	2.213E-03	2.674E-08	5.533E-04
Cobalt	6.352E-05	3.763E-06	7.400E-07	2.114E-07	3.357E-04	4.056E-09	8.392E-05
Copper	2.129E-01	1.159E-03	2.622E-03	7.490E-04	1.189E+00	1.437E-05	2.973E-01
Lead	1.527E-02	6.770E-05	1.882E-04	5.378E-05	8.538E-02	1.032E-06	2.134E-02
Manganese	1.337E-03	3.086E-05	1.618E-05	4.622E-06	7.338E-03	8.867E-08	1.835E-03
Nickel	6.241E-04	1.433E-05	7.551E-06	2.157E-06	3.425E-03	4.138E-08	8.562E-04
Selenium	2.675E-04	5.497E-06	ND	ND	ND	ND	ND
Silver	5.349E-05	1.099E-06	ND	ND	ND	ND	ND
Thallium	8.024E-05	1.613E-06	ND	ND	ND	ND	ND
Zinc	4.012E-02	1.445E-04	4.950E-04	1.414E-04	2.245E-01	2.713E-06	5.613E-02

Footnotes:

ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-47: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC; D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
<b>VOCs</b>							
Dichlorodifluoromethane	3.762E-03	3.762E-03	ND	ND	ND	ND	ND
Methyl Chloride	1.594E-03	1.594E-03	ND	ND	ND	ND	ND
Dichlorotetrafluoroethane	4.683E-03	4.683E-03	ND	ND	ND	ND	ND
Vinyl Chloride	5.069E-03	5.069E-03	ND	ND	ND	ND	ND
1,3-Butadiene	1.790E-03	1.790E-03	ND	ND	ND	ND	ND
Methyl Bromide	3.073E-03	3.073E-03	ND	ND	ND	ND	ND
Ethyl Chloride	2.112E-03	2.112E-03	ND	ND	ND	ND	ND
Trichlorofluoromethane	3.934E-03	3.934E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	9.135E-03	6.696E-03	3.021E-05	8.632E-06	1.370E-02	1.656E-07	3.426E-03
Dichloromethane	1.697E-01	5.722E-03	2.031E-03	5.803E-04	9.213E-01	1.113E-05	2.303E-01
3-Chloropropene	2.754E-03	2.754E-03	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	4.767E-03	5.750E-03	ND	ND	ND	ND	ND
1,1-Dichloroethane	3.159E-03	3.159E-03	ND	ND	ND	ND	ND
cis-1,2-Dichloroethane	3.295E-03	3.295E-03	ND	ND	ND	ND	ND
Trichloromethane	4.099E-03	4.099E-03	ND	ND	ND	ND	ND
1,2-Dichloroethane	3.443E-03	3.443E-03	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	1.257E-01	1.095E-01	2.011E-04	5.745E-05	9.121E-02	1.102E-06	2.280E-02
Benzene	5.461E-02	2.329E-03	6.763E-04	1.932E-04	3.068E-01	3.706E-06	7.669E-02
Carbon Tetrachloride	4.529E-03	4.529E-03	ND	ND	ND	ND	ND
1,2-Dichloropropane	3.419E-03	3.419E-03	ND	ND	ND	ND	ND
Trichloroethene	3.866E-03	3.866E-03	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	3.360E-03	3.360E-03	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	2.860E-03	2.860E-03	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	3.877E-03	3.877E-03	ND	ND	ND	ND	ND
Toluene	7.167E-03	3.610E-03	4.404E-05	1.258E-05	1.998E-02	2.414E-07	4.994E-03
1,2-Dibromoethane	5.844E-03	5.844E-03	ND	ND	ND	ND	ND
Tetrachloroethane	4.475E-03	4.475E-03	ND	ND	ND	ND	ND

Table B-47: Air Modeling Output Data for Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC): 4.833E-05 (g/m³)/(g/s)	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) In lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
Chlorobenzene	2.305E-04	2.305E-04	ND	ND	ND	ND	ND
Ethylbenzene	2.344E-03	2.344E-03	ND	ND	ND	ND	ND
m&p-Xylene	2.257E-03	2.257E-03	ND	ND	ND	ND	ND
Styrene	2.641E-03	2.641E-03	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	4.466E-03	4.466E-03	ND	ND	ND	ND	ND
o-Xylene	2.474E-03	2.474E-03	ND	ND	ND	ND	ND
4-Ethyltoluene	2.214E-03	2.214E-03	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	2.460E-03	2.460E-03	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	2.312E-03	2.312E-03	ND	ND	ND	ND	ND
Benzyl Chloride	5.076E-03	5.076E-03	ND	ND	ND	ND	ND
m-Dichlorobenzene	3.366E-03	3.366E-03	ND	ND	ND	ND	ND
p-Dichlorobenzene	2.945E-03	2.945E-03	ND	ND	ND	ND	ND
o-Dichlorobenzene	3.606E-03	3.606E-03	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	4.526E-03	4.526E-03	ND	ND	ND	ND	ND
Hexachlorobutadiene	4.690E-03	4.690E-03	ND	ND	ND	ND	ND
Methane	2.130E+00	1.364E+00	9.490E-03	2.712E-03	4.305E+00	5.201E-05	1.076E+00
Ethane	6.764E-01	6.764E-01	ND	ND	ND	ND	ND
Ethylene	6.310E-01	6.310E-01	ND	ND	ND	ND	ND
Propane	9.920E-01	9.920E-01	ND	ND	ND	ND	ND
Acetylene	5.858E-01	5.858E-01	ND	ND	ND	ND	ND
Isobutane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
n-Butane	1.307E+00	1.307E+00	ND	ND	ND	ND	ND
Propylene	9.466E-01	9.466E-01	ND	ND	ND	ND	ND
Footnotes:							
*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)							
ND = Not Detected							



Table B-48: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
<b>SVOCs</b>							
n-nitrosodimethylamine	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-chloroethyl)ether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
phenol	2.642E-02	1.712E-02	1.151E-04	3.289E-05	5.221E-02	6.309E-07	1.305E-02
2-chlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,3-dichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,4-dichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,2-dichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
benzyl alcohol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-chloroisopropyl)ether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-methylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
hexachloroethane	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
n-nitroso-di-n-propylamine	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-methylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
nitrobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
isophorone	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-nitrophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4-dimethylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-chloroethoxy)methane	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4-dichlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
naphthalene	3.145E-03	2.446E-03	3.894E-05	1.113E-05	1.766E-02	2.134E-07	4.416E-03
4-chloroaniline	2.402E-02	2.446E-02	ND	ND	ND	ND	ND
hexachlorobutadiene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-chloro-3-methylphenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-methylnaphthalene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
hexachlorocyclopentadiene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4,6-trichlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND

Table B-48: Air Modeling Output Data for Semi-Volatile Organic Compounds - 200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m³) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>i</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
	Measured Actual Concentration (mg/m³)	Measured Background Concentration (mg/m³)	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)			
ATC Firing Test Results							
2,4,5-trichlorophenol	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-chloronaphthalene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2-nitroaniline	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
dimethylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,6-dinitrotoluene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
3-nitroaniline	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
2,4-dinitrophenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
dibenzofuran	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
2,4-dinitrotoluene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-nitrophenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
4-chlorophenyl-phenylether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
diethylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-nitroaniline	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
4,6-dinitro-2-methylphenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
n-nitrosodiphenylamine(1)	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
4-bromophenyl-phenylether	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
hexachlorobenzene	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
pentachlorophenol	4.803E-03	4.892E-03	ND	ND	ND	ND	ND
di-n-butylphthalate	5.873E-03	2.446E-03	7.273E-05	2.078E-05	3.299E-02	3.986E-07	8.248E-03
butylbenzylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate	7.191E-02	1.027E-01	ND	ND	ND	ND	ND
di-n-octylphthalate	2.402E-03	2.446E-03	ND	ND	ND	ND	ND

Footnotes:  
ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)  
ND = Not Detected

Footnotes:

\*ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

**Table B-49: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540					No. of rounds (l) release duration (t); Unit Concentration (UC);	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
Net Explosive Weight (NEW) in lbs. => Number of Items = 1 SF6 Leak Rate Dilution Factor =>							
3.50 0.932							
Compound	Average Adjusted Emission Factor						
	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
PAHs (TO-13 Method)							
acenaphthylene	5.329E-04	1.027E-05	6.472E-06	1.849E-06	2.936E-03	3.547E-08	7.339E-04
acenaphthene	1.682E-04	3.180E-04	ND	ND	ND	ND	ND
fluorene	2.490E-04	2.275E-04	2.658E-07	7.595E-08	1.206E-04	1.457E-09	3.015E-05
phenanthrene	3.516E-04	1.932E-04	1.961E-06	5.604E-07	8.897E-04	1.075E-08	2.224E-04
anthracene	5.198E-05	7.094E-06	5.558E-07	1.588E-07	2.521E-04	3.046E-09	6.303E-05
fluoranthene	1.712E-04	1.614E-05	1.920E-06	5.486E-07	8.709E-04	1.052E-08	2.177E-04
pyrene	3.254E-04	1.663E-05	3.823E-06	1.092E-06	1.734E-03	2.095E-08	4.335E-04
benzo(a)anthracene	2.751E-05	2.446E-06	3.406E-07	9.732E-08	1.545E-04	1.867E-09	3.863E-05
chrysene	2.751E-05	2.446E-06	3.406E-07	9.732E-08	1.545E-04	1.867E-09	3.863E-05
benzo(b)fluoranthene	7.178E-05	2.446E-06	8.889E-07	2.540E-07	4.032E-04	4.872E-09	1.008E-04
benzo(k)fluoranthene	4.740E-05	2.446E-06	5.870E-07	1.677E-07	2.662E-04	3.217E-09	6.656E-05
benzo(a)pyrene	1.089E-04	2.446E-06	1.349E-06	3.854E-07	6.119E-04	7.393E-09	1.530E-04
Indeno(1,2,3-cd)pyrene	1.530E-04	2.935E-06	1.858E-06	5.309E-07	8.428E-04	1.018E-08	2.107E-04
dibenz(a,h)anthracene	5.148E-06	2.446E-06	6.375E-08	1.821E-08	2.892E-05	3.494E-10	7.229E-06
benzo(g,h,i)perylene	2.715E-04	5.626E-06	3.292E-06	9.406E-07	1.493E-03	1.804E-08	3.733E-04
Dioxin/Furan Data							
2378-TCDD	4.245E-10	8.000E-12	ND	ND	ND	ND	ND
12378-PECDD	3.225E-10	9.000E-12	ND	ND	ND	ND	ND
123478-HXCDD	5.490E-10	1.050E-11	ND	ND	ND	ND	ND
123678-HXCDD	7.690E-10	1.700E-11	9.312E-12	2.661E-12	4.224E-09	5.104E-14	1.056E-09
123789-HXCDD	8.705E-10	1.550E-11	1.059E-11	3.025E-12	4.802E-09	5.803E-14	1.201E-09
1234678-HP/CDD	9.178E-09	2.495E-10	1.106E-10	3.159E-11	5.015E-08	6.059E-13	1.254E-08
OCDD	4.458E-08	1.587E-09	5.324E-10	1.521E-10	2.415E-07	2.918E-12	6.037E-08
2378-TCDF	1.230E-10	1.100E-11	ND	ND	ND	ND	ND
12378-PECDF	3.375E-10	1.050E-11	ND	ND	ND	ND	ND
23478-PECDF	1.950E-10	1.550E-11	ND	ND	ND	ND	ND
123478-HX/CDF	1.840E-10	2.800E-11	ND	ND	ND	ND	ND
123678-HX/CDF	1.795E-10	1.450E-11	ND	ND	ND	ND	ND
123789-HX/CDF	3.220E-10	6.000E-12	ND	ND	ND	ND	ND

**Table B-49: Air Modeling Output Data for Polynuclear Aromatic Hydrocarbons, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

Compound	155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (I) release duration (I): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> ) CONC	Substance Emission Rate for One Round (g/sec) ER <sub>1</sub>
	Net Explosive Weight (NEW) in lbs. => 3.50						
	Number of Items = 1						
	SF6 Leak Rate Dilution Factor => 0.932						
ATC Firing Data							
Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item) M			
234678-HXCDF	2.640E-10	1.200E-11	ND	ND	ND	ND	ND
1234678-HPCDF	7.080E-10	7.750E-11	7.808E-12	2.231E-12	3.541E-09	4.279E-14	8.854E-10
1234789-HPCDF	3.755E-10	8.000E-12	ND	ND	ND	ND	ND
OCDF	1.436E-09	1.105E-10	1.641E-11	4.690E-12	7.445E-09	8.996E-14	1.861E-09
Aldehydes							
Formaldehyde	1.228E-02	1.228E-02	ND	ND	ND	ND	ND
Acetaldehyde	1.802E-02	1.802E-02	ND	ND	ND	ND	ND
Acetone	3.563E-02	4.751E-02	ND	ND	ND	ND	ND
Acrolein	2.294E-02	2.294E-02	ND	ND	ND	ND	ND
Propionaldehyde	2.374E-02	2.374E-02	ND	ND	ND	ND	ND
Crotonaldehyde	2.867E-02	2.867E-02	ND	ND	ND	ND	ND
Butyraldehyde	2.949E-02	2.949E-02	ND	ND	ND	ND	ND
Benzaldehyde	4.340E-02	4.340E-02	ND	ND	ND	ND	ND
Isovaleraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
Valeraldehyde	3.523E-02	3.523E-02	ND	ND	ND	ND	ND
o,m,p-Tolualdehyde	9.828E-02	9.828E-02	ND	ND	ND	ND	ND
Hexaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	4.097E-02	4.097E-02	ND	ND	ND	ND	ND
Acid gases							
Hydrogen fluoride	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Hydrogen chloride	1.300E-01	1.300E-01	ND	ND	ND	ND	ND
Hydrogen bromide	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Nitric Acid	2.400E-01	2.200E-01	2.477E-04	7.076E-05	1.123E-01	1.357E-06	2.808E-02
Phosphoric acid	1.400E-01	1.400E-01	ND	ND	ND	ND	ND
Sulfuric Acid	2.950E-01	1.400E-01	3.653E-03	1.044E-03	1.657E+00	2.002E-05	4.142E-01

Footnotes:

ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)

ND = Not Detected

Table B-50: Air Modeling Output Data for Cyanide and Energetics - 200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				No. of rounds (l) release duration (t): Unit Concentration (UC):	Average Modeled Concentration for One Round (grams/m <sup>3</sup> )  CONC	Substance Emission Rate for One Round (g/sec)  ER <sub>1</sub>
Net Explosive Weight (NEW) in lbs. => 3.50 Number of Items = 1 SF6 Leak Rate Dilution Factor => 0.932						
ATC Firing Test Results						
Compound	Measured Actual Concentration (mg/m <sup>3</sup> )	Measured Background Concentration (mg/m <sup>3</sup> )	Average Adjusted Emission Factor (lb/item) EF	Average Adjusted Emission Factor (lb/lb NEW)	Total Mass of Substance Emitted (grams/item)  M	
Particulate Cyanide and HCN						
Particulate Cyanide	8.000E-02	8.000E-02	ND	ND	ND	ND
Hydrogen Cyanide	9.000E-01	8.500E-02	1.114E-02	3.184E-03	5.055E+00	1.264E+00
Energetics Data						
Nitrobenzene	4.713E-01	2.031E-01	ND	ND	ND	ND
2-Nitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
3-Nitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
4-Nitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
Nitroglycerine	4.713E-01	2.031E-01	ND	ND	ND	ND
1,3-Dinitrobenzene	4.713E-01	2.031E-01	ND	ND	ND	ND
2,6-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
2,4-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
1,3,5-Trinitrobenzene	4.713E-01	2.031E-01	ND	ND	ND	ND
2,4,6-Trinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
RDX	4.713E-01	2.031E-01	ND	ND	ND	ND
4-Amino-2,6-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
2-Amino-4,6-Dinitrotoluene	4.713E-01	2.031E-01	ND	ND	ND	ND
Tetryl	4.713E-01	2.031E-01	ND	ND	ND	ND
HMX	9.426E-01	4.062E-01	ND	ND	ND	ND
Pentaerythritoltetranitrate	9.426E-01	4.062E-01	ND	ND	ND	ND
Dibutyl phthalate	2.357E+01	1.016E+01	ND	ND	ND	ND
Diethyl phthalate	2.357E+01	1.016E+01	ND	ND	ND	ND
Diphenylamine	1.178E+01	5.078E+00	ND	ND	ND	ND
Footnotes:						
1ATC = Aberdeen Test Center (for additional information on the data, refer to the Firing Point Emissions Study)						
ND = Not Detected						

## APPENDIX C

# HEALTH-BASED SCREENING LEVELS AND ACUTE TOXICITY VALUES



Appendix C: Health-based Screening Levels and Acute Toxicity Values											
		For the Chronic Evaluation (HBSL)					For the Acute Evaluation (ATV)				
Compound	CAS #	Region 9 PRG (µg/m³)	Toxicity Endpoint (c or nc)	Region 3 RBC (µg/m³)	Toxicity Endpoint (c or nc)	Health-based Screening Level (µg/m³)	ERPG (µg/m³)	TEEL (µg/m³)	AEGL (µg/m³)	Source (T or E)	Acute Toxicity Value (µg/m³)
<b>Permanent Gases</b>											
NH <sub>3</sub>	7664-41-7	1.04E+02	nc	1.04E+02	nc	1.04E+02	1.75E+04	1.75E+04	NA	E	1.75E+04
Carbon Dioxide (CO <sub>2</sub> )	124-38-9	NA		NA		NA	NA	5.40E+07	NA	T	5.40E+07
Carbon Monoxide (CO)	630-08-0	1.57E+02		NA		1.57E+02	2.30E+05	2.28E+05	NA	E	2.30E+05
Nitrogen Oxides (as NO)	10024-97-2	1.00E+02		NA		1.00E+02	NA	2.70E+05	NA	T	2.70E+05
Methane (CH <sub>4</sub> )	74-82-8	NA		NA		NA	NA	3.30E+06	NA	T	3.30E+06
Sulfur Dioxide (SO <sub>2</sub> )	7446-09-5	8.00E+01		NA		8.00E+01	7.89E+02	7.86E+02	NA	E	7.89E+02
<b>Particulate Matter</b>											
TSP	12789-66-1	5.00E+01		NA		5.00E+01	NA	NA	NA		NA
PM <sub>10</sub>		5.00E+01		NA		5.00E+01	NA	NA	NA		NA
PM <sub>2.5</sub>		1.50E+01		NA		1.50E+01	NA	NA	NA		NA
<b>Metals</b>											
Antimony	7440-36-0	NA		1.46E+00	nc	1.46E+00	NA	1.50E+03	NA	T	1.50E+03
Arsenic	7440-38-2	4.47E-04	c	4.15E-04	c	4.47E-04	NA	3.00E+01	NA	T	3.00E+01
Barium	7440-39-3	5.21E-01	nc	5.11E-01	nc	5.21E-01	NA	1.50E+03	NA	T	1.50E+03
Beryllium	7440-41-7	8.00E-04	c	7.45E-04	c	8.00E-04	NA	5.00E+00	NA	T	5.00E+00
Cadmium	7440-43-9	1.07E-03	c	9.94E-04	c	1.07E-03	NA	3.00E+01	NA	T	3.00E+01
Chromium	7440-47-3		c	1.53E-04	c	1.53E-04	NA	1.50E+03	NA	T	1.50E+03
Cobalt	7440-48-4	NA		2.20E+02	nc	2.20E+02	NA	6.00E+01	NA	T	6.00E+01
Copper	7440-50-8	NA		1.46E+02	nc	1.46E+02	NA	3.00E+03	NA	T	3.00E+03
Lead	7439-92-1	1.50E+00		NA		1.50E+00	NA	1.50E+02	NA	T	1.50E+02
Manganese	7439-96-5	5.11E-02	nc	5.22E-02	nc	5.11E-02	NA	3.00E+03	NA	T	3.00E+03
Nickel	7440-02-0	NA		7.30E+01	nc	7.30E+01	NA	3.00E+03	NA	T	3.00E+03
Selenium	7782-49-2	NA		1.83E+01	nc	1.83E+01	NA	6.00E+02	NA	T	6.00E+02
Silver	7740-22-4	NA		1.83E+01	nc	1.83E+01	NA	3.00E+02	NA	T	3.00E+02
Thallium	7440-28-0	NA		2.56E-01	nc	2.56E-01	NA	3.00E+02	NA	T	3.00E+02
Zinc	7440-66-6	NA		1.10E+03	nc	1.10E+03	NA	3.00E+04	NA	T	3.00E+04
<b>VOCs</b>											
Dichlorodifluoromethane	75-71-8	2.09E+02	nc	1.83E+02	nc	2.09E+02	NA	1.48E+07	NA	T	1.48E+07
Methyl Chloride	74-87-3	1.07E+00	c	1.79E+00	c	1.07E+00	NA	2.06E+05	NA	T	2.06E+05
Dichlorotetrafluoroethane	1320-37-2	NA		NA		NA	NA	NA	NA		NA
Vinyl Chloride	75-01-4	2.20E-02	c	2.10E-02	c	2.20E-02	NA	1.28E+04	NA	T	1.28E+04
1,3-Butadiene	106-99-0	3.74E-03	c	3.48E-03	c	3.74E-03	2.20E+04	2.21E+04	NA	E	2.20E+04
Methyl Bromide	74-83-9	5.21E+00	nc	5.11E+00	nc	5.21E+00	NA	5.82E+04	NA	T	5.82E+04
Ethyl Chloride	75-00-3	2.32E+00	nc	NA		2.32E+00	NA	7.92E+06	NA	T	7.92E+06
Trichlorofluoromethane	75-69-4	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	2.81E+06	NA	T	2.81E+06
1,1-Dichloroethene	75-35-4	3.84E-02	c	3.58E-02	c	3.84E-02	NA	7.92E+04	5.30E+04	A	7.92E+04
Dichloromethane	75-09-2	4.09E+00	c	3.79E+00	c	4.09E+00	6.96E+05	6.94E+05	NA	E	6.96E+05

Appendix C: Health-based Screening Levels and Acute Toxicity Values										
		For the Chronic Evaluation (HBSL)					For the Acute Evaluation (ATV)			
Compound	CAS #	Region 9 PRG (µg/m³)	Toxicity Endpoint (c or nc)	Region 3 RBC (µg/m³)	Toxicity Endpoint (c or nc)	Health-based Screening Level (µg/m³)	ERPG (µg/m³)	TEEL (µg/m³)	AEGL (µg/m³)	Acute Toxicity Value (µg/m³)
3-Chloropropene	107-05-1	1.04E+00	nc	NA		1.04E+00	9.39E+03	9.39E+03	NA	9.39E+03
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	3.13E+04	nc	3.14E+04	nc	3.13E+04	NA	9.58E+06	NA	9.58E+06
1,1-Dichloroethane	75-34-3	5.21E+02	nc	5.11E+02	nc	5.21E+02	NA	1.21E+06	NA	1.21E+06
cis-1,2-Dichloroethene	156-59-2	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	7.92E+05	NA	7.92E+05
Trichloromethane	67-66-3	8.35E-02	c	7.70E-02	c	8.35E-02	NA	9.76E+03	NA	9.76E+03
1,2-Dichloroethane	107-06-2	7.39E-02	c	6.88E-02	c	7.39E-02	NA	8.08E+03	NA	8.08E+03
1,1,1-Trichloroethane	71-55-6	1.04E+03	nc	2.30E+03	nc	1.04E+03	1.94E+06	1.91E+06	NA	1.94E+06
Benzene	71-43-2	2.49E-01	c	2.16E-01	c	2.49E-01	1.56E+05	1.60E+05	NA	1.56E+05
Carbon Tetrachloride	56-23-5	1.28E-01	c	1.18E-01	c	1.28E-01	1.28E+05	1.26E+05	NA	1.28E+05
1,2-Dichloropropane	78-87-5	9.89E-02	c	9.21E-02	c	9.89E-02	NA	5.08E+05	NA	5.08E+05
Trichloroethene	79-01-6	1.12E+00	c	1.04E+00	c	1.12E+00	5.38E+05	5.37E+05	NA	5.38E+05
cis-1,3-Dichloropropene	10061-01-5	5.17E-02	c	4.82E-02	c	5.17E-02	NA	1.14E+04	NA	1.14E+04
trans-1,3-Dichloropropene	10061-02-6	5.17E-02	c	4.82E-02	c	5.17E-02	NA	NA	NA	NA
1,1,2-Trichloroethane	79-00-5	1.20E-01	c	1.12E-01	c	1.20E-01	NA	1.64E+05	NA	1.64E+05
Toluene	108-88-3	4.02E+02	nc	4.16E+02	nc	4.02E+02	1.88E+05	1.89E+05	NA	1.88E+05
1,2-Dibromoethane	106-93-4	8.73E-03	c	8.24E-03	c	8.73E-03	NA	1.54E+05	NA	1.54E+05
Tetrachloroethene	127-18-4	3.31E+00	c	3.13E+00	c	3.31E+00	NA	6.78E+05	NA	6.78E+05
Chlorobenzene	108-90-7	6.21E+01	nc	6.21E+01	nc	6.21E+01	NA	1.38E+05	NA	1.38E+05
Ethylbenzene	100-41-4	1.06E+03	nc	1.06E+03	nc	1.06E+03	NA	5.43E+05	NA	5.43E+05
m&p-Xylene	108-38-3	7.30E+02	nc	7.30E+03	nc	7.30E+02	NA	6.51E+05	NA	6.51E+05
Styrene	100-42-5	1.06E+03	nc	1.04E+03	nc	1.06E+03	2.13E+05	2.13E+05	NA	2.13E+05
1,1,2,2-Tetrachloroethane	79-34-5	3.31E-02	c	3.13E-02	c	3.31E-02	NA	2.06E+04	NA	2.06E+04
o-Xylene	95-47-6	7.30E+02	nc	7.30E+03	nc	7.30E+02	NA	6.51E+05	NA	6.51E+05
4-Ethyltoluene	622-96-8	NA		NA		NA	NA	1.25E+05	NA	1.25E+05
1,3,5-Trimethylbenzene	108-67-8	6.21E+00	nc	6.21E+00	nc	6.21E+00	NA	3.68E+05	NA	3.68E+05
1,2,4-Trimethylbenzene	95-63-6	6.21E+00	nc	6.21E+00	nc	6.21E+00	NA	1.80E+05	NA	1.80E+05
Benzyl Chloride	100-44-7	3.96E-02	c	3.68E-02	c	3.96E-02	5.20E+03	5.17E+03	NA	5.20E+03
m-Dichlorobenzene	541-73-1	3.29E+00	nc	3.29E+00	nc	3.29E+00	NA	3.61E+04	NA	3.61E+04
p-Dichlorobenzene	106-46-7	3.06E-01	c	2.85E-01	c	3.06E-01	NA	6.61E+05	NA	6.61E+05
o-Dichlorobenzene	95-50-1	2.09E+02	nc	3.29E+01	nc	2.09E+02	NA	3.01E+05	NA	3.01E+05
1,2,4-Trichlorobenzene	120-82-1	2.08E+02	nc	2.08E+02	nc	2.08E+02	NA	3.71E+04	NA	3.71E+04
Hexachlorobutadiene	87-68-3	8.62E-02	c	8.03E-02	c	8.62E-02	3.21E+04	3.20E+04	NA	3.21E+04
Hydrocarbons										
Methane	74-82-8	NA		NA		NA	NA	3.30E+06	NA	3.30E+06
Ethane	74-84-0	NA		NA		NA	NA	NA	NA	NA
Ethylene	74-85-1	NA		NA		NA	NA	4.60E+05	NA	4.60E+05
Propane	74-98-6	NA		NA		NA	NA	3.78E+06	NA	3.78E+06
Acetylene	74-86-2	NA		NA		NA	NA	NA	NA	NA

Appendix C: Health-based Screening Levels and Acute Toxicity Values											
For the Chronic Evaluation (HBSL)											
Compound	CAS #	Region 9 PRG (µg/m³)	Toxicity Endpoint (c or nc)	Region 3 RBC (µg/m³)	Toxicity Endpoint (c or nc)	Health-based Screening Level (µg/m³)	ERPG (µg/m³)	For the Acute Evaluation (ATV)			
								TEEL (µg/m³)	AEGL (µg/m³)	Source (T or E)	Acute Toxicity Value (µg/m³)
Isobutane	75-28-5	NA		NA		NA	NA	9.52E+05	NA	T	9.52E+05
n-Butane	106-97-8	NA		NA		NA	NA	5.71E+06	NA	T	5.71E+06
Propylene	115-07-1	NA		NA		NA	NA	NA	NA		NA
SVOCs											
n-nitrosodimethylamine	62-75-9	1.37E-04	c	1.23E-04		1.37E-04	NA	2.50E+03	NA	T	2.50E+03
bis(2-chloroethyl)ether	111-44-4	5.82E-03	c	5.69E-03	c	5.82E-03	NA	5.85E+04	NA	T	5.85E+04
phenol	108-95-2	2.19E+03	nc	2.19E+03	nc	2.19E+03	NA	3.85E+04	NA	T	3.85E+04
2-chlorophenol	95-57-8	1.83E+01	nc	1.83E+01	nc	1.83E+01	NA	5.25E+03	NA	T	5.25E+03
1,3-dichlorobenzene	541-73-1	3.29E+00	nc	3.29E+00	nc	3.29E+00	NA	3.61E+04	NA	T	3.61E+04
1,4-dichlorobenzene	106-46-7	3.06E-01	c	2.85E-01	c	3.06E-01	NA	6.61E+05	NA	T	6.61E+05
1,2-dichlorobenzene	95-50-1	2.09E+02	nc	3.29E+01	nc	2.09E+02	NA	3.01E+05	NA	T	3.01E+05
benzyl alcohol	100-51-6	1.10E+03	nc	1.10E+03	nc	1.10E+03	NA	5.53E+04	NA	T	5.53E+04
bis(2-chloroisopropyl)ether	108-60-1	1.92E-01	c	1.79E-01	c	1.92E-01	NA	6.99E+04	NA	T	6.99E+04
2-methylphenol	95-48-7	1.83E+02	nc	1.83E+02	nc	1.83E+02	NA	NA	NA		NA
hexachloroethane	67-72-1	4.80E-01	c	4.47E-01	c	4.80E-01	NA	2.90E+04	NA	T	2.90E+04
n-nitroso-di-n-propylamine	621-64-7	9.61E-04	c	8.94E-04	c	9.61E-04	NA	2.00E+02	NA	T	2.00E+02
4-methylphenol	106-44-5	1.83E+02	nc	1.83E+02	nc	1.83E+02	NA	NA	NA		NA
nitrobenzene	98-95-3	2.09E+00	nc	2.19E+00	nc	2.09E+00	NA	1.51E+04	NA	T	1.51E+04
isophorone	78-59-1	7.08E+00	c	6.59E+00	c	7.08E+00	NA	2.83E+04	NA	T	2.83E+04
2-nitrophenol	88-75-5	NA		NA		NA	NA	NA	NA		NA
2,4-dimethylphenol	105-67-9	7.30E+01	nc	7.30E+01	nc	7.30E+01	NA	NA	NA		NA
bis(2-chloroethoxy)methane	111-91-1	NA		NA		NA	NA	NA	NA		NA
2,4-dichlorophenol	120-83-2	1.10E+01	nc	1.10E+01	nc	1.10E+01	NA	3.00E+04	NA	T	3.00E+04
1,2,4-trichlorobenzene	120-82-1	2.08E+02	nc	2.08E+02	nc	2.08E+02	NA	3.71E+04	NA	T	3.71E+04
naphthalene	91-20-3	3.13E+00	nc	3.29E+00	nc	3.13E+00	NA	7.86E+04	NA	T	7.86E+04
4-chloroaniline	106-47-8	1.46E+01	nc	1.46E+01	nc	1.46E+01	NA	3.00E+04	NA	T	3.00E+04
hexachlorobutadiene	87-68-3	8.62E-02	c	8.03E-02	c	8.62E-02	3.21E+04	3.20E+04	NA	E	3.21E+04
4-chloro-3-methylphenol	59-50-7	NA		NA		NA	NA	2.00E+04	NA	T	2.00E+04
2-methylnaphthalene	91-57-6	NA		7.30E+01	nc	7.30E+01	NA	2.00E+04	NA	T	2.00E+04
hexachlorocyclopentadiene	77-47-4	7.30E-02	nc	7.30E-02	nc	7.30E-02	NA	2.23E+02	NA	T	2.23E+02
2,4,6-trichlorophenol	88-06-2	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	3.00E+04	NA	T	3.00E+04
2,4,5-trichlorophenol	95-95-4	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	3.00E+04	NA	T	3.00E+04
2-chloronaphthalene	91-58-7	2.92E+02	nc	2.92E+02	nc	2.92E+02	NA	6.00E+02	NA	T	6.00E+02
2-nitroaniline	88-74-4	2.09E-01	nc	2.08E-01	nc	2.09E-01	NA	NA	NA		NA
dimethylphthalate	131-11-3	3.65E+04	nc	3.65E+04	nc	3.65E+04	NA	1.50E+04	NA	T	1.50E+04
2,6-dinitrotoluene	606-20-2	3.65E+00	nc	3.65E+00	nc	3.65E+00	NA	6.00E+02	NA	T	6.00E+02
3-nitroaniline	99-09-2	NA		NA		NA	NA	NA	NA		NA
2,4-dinitrophenol	51-28-5	7.30E+00	nc	7.30E+00	nc	7.30E+00	NA	7.50E+03	NA	T	7.50E+03
dibenzofuran	132-64-9	1.46E+01	nc	1.46E+01	nc	1.46E+01	NA	NA	NA		NA



Appendix C: Health-based Screening Levels and Acute Toxicity Values											
Compound	CAS #	For the Chronic Evaluation (HBSL)					For the Acute Evaluation (ATV)				
		Region 9 PRG (µg/m³)	Toxicity Endpoint (c or nc)	Region 3 RBC (µg/m³)	Toxicity Endpoint (c or nc)	Health-based Screening Level (µg/m³)	ERPG (µg/m³)	TEEL (µg/m³)	AEGL (µg/m³)	Source (T or E)	Acute Toxicity Value (µg/m³)
2,4-dinitrotoluene	121-14-2	7.30E+00	nc	7.30E+00	nc	7.30E+00	NA	6.00E+02	NA	T	6.00E+02
4-nitrophenol	100-02-7	2.92E+01	nc	2.92E+01	nc	2.92E+01	NA	3.00E+04	NA	T	3.00E+04
4-chlorophenyl-phenylether	7005-72-3	NA		NA		NA	NA	NA	NA		NA
diethylphthalate	84-66-2	2.92E+03	nc	2.92E+03	nc	2.92E+03	NA	1.50E+04	NA	T	1.50E+04
4-nitroaniline	100-01-6	NA		NA		NA	NA	9.00E+03	NA	T	9.00E+03
4,6-dinitro-2-methylphenol	534-52-1	NA		3.65E-01	nc	3.65E-01	NA	5.00E+02	NA	T	5.00E+02
n-nitrosodiphenylamine(1)	86-30-6	1.37E+00	c	1.28E+00	c	1.37E+00	NA	NA	NA		NA
4-bromophenyl-phenylether	101-55-3	NA		NA		NA	NA	NA	NA		NA
hexachlorobenzene	118-74-1	4.18E-03	c	3.91E-03	c	4.18E-03	NA	7.50E+01	NA	T	7.50E+01
pentachlorophenol	87-86-5	5.60E-02	c	5.22E-02	c	5.60E-02	NA	1.50E+03	NA	T	1.50E+03
di-n-butylphthalate	84-74-2	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	1.50E+04	NA	T	1.50E+04
butylbenzylphthalate	85-68-7	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	5.00E+05	NA	T	5.00E+05
bis(2-ethylhexyl)phthalate	117-81-7	4.80E-01	c	4.47E-01	c	4.80E-01	NA	1.00E+04	NA	T	1.00E+04
di-n-octylphthalate	117-84-0	7.30E+01	nc	7.30E+01	nc	7.30E+01	NA	1.50E+05	NA	T	1.50E+05
PAHs											
acenaphthylene	208-96-8	NA		NA		NA	NA	2.00E+02	NA	T	2.00E+02
acenaphthene	83-32-9	2.19E+02	nc	2.19E+02	nc	2.19E+02	NA	1.25E+03	NA	T	1.25E+03
fluorene	86-73-7	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	7.50E+04	NA	T	7.50E+04
phenanthrene	85-01-8	NA		NA		NA	NA	2.00E+03	NA	T	2.00E+03
anthracene	120-12-7	1.10E+03	nc	1.10E+03	nc	1.10E+03	NA	6.00E+03	NA	T	6.00E+03
fluoranthene	206-44-0	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	3.00E+01	NA	T	3.00E+01
pyrene	129-00-0	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	1.50E+04	NA	T	1.50E+04
benzo(a)anthracene	56-55-3	2.17E-02	c	8.58E-03	c	2.17E-02	NA	6.00E+02	NA	T	6.00E+02
chrysene	218-01-9	2.17E+00	c	8.58E-01	c	2.17E+00	NA	2.00E+02	NA	T	2.00E+02
benzo(b)fluoranthene	205-99-2	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA	NA		NA
benzo(k)fluoranthene	207-08-9	2.17E-01	c	8.58E-02	c	2.17E-01	NA	NA	NA		NA
benzo(a)pyrene	50-32-8	2.17E-03	c	2.02E-03	c	2.17E-03	NA	7.50E+03	NA	T	7.50E+03
indeno(1,2,3-cd)pyrene	193-39-5	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA	NA		NA
dibenz(a,h)anthracene	53-70-3	2.17E-03	c	8.58E-04	c	2.17E-03	NA	3.00E+04	NA	T	3.00E+04
benzo(g,h,i)perylene	191-24-2	NA		NA		NA	NA	3.00E+04	NA	T	3.00E+04
Dioxins / Furans											
2378-Tetrachlorodibenzo-p-dioxin	1746-01-6	4.48E-08	c	4.17E-08	c	4.48E-08	NA	3.50E+00	NA	T	3.50E+00
12378-Pentachlorodibenzo-p-dioxin	40321-76-4	NA		NA		NA	NA	2.50E+00	NA	T	2.50E+00
123478-Hexachlorodibenzo-p-dioxin	39227-28-6	NA		NA		NA	NA	NA	NA		NA
123678-Hexachlorodibenzo-p-dioxin	57653-85-7	NA		NA		NA	NA	1.50E+01	NA	T	1.50E+01
123789-Hexachlorodibenzo-p-dioxin	19408-74-3	1.48E-06	c	1.38E-06	c	1.48E-06	NA	NA	NA		NA
1234678-Heptachlorodibenzo-p-dioxin	35822-46-9	NA		NA		NA	NA	NA	NA		NA
Octachlorodibenzo-p-dioxin	3268-87-9	NA		NA		NA	NA	NA	NA		NA
2378-Tetrachlorodibenzo-p-furan	51207-31-9	NA		NA		NA	NA	2.00E+00	NA	T	2.00E+00

Appendix C: Health-based Screening Levels and Acute Toxicity Values											
Compound	CAS #	For the Chronic Evaluation (HBSL)					For the Acute Evaluation (ATV)				
		Region 9 PRG (µg/m³)	Toxicity Endpoint (c or nc)	Region 3 RBC (µg/m³)	Toxicity Endpoint (c or nc)	Health-based Screening Level (µg/m³)	ERPG (µg/m³)	TEEL (µg/m³)	AEGL (µg/m³)	Source (T or E)	Acute Toxicity Value (µg/m³)
2,4-dinitrotoluene	121-14-2	7.30E+00	nc	7.30E+00	nc	7.30E+00	NA	6.00E+02	NA	T	6.00E+02
4-nitrophenol	100-02-7	2.92E+01	nc	2.92E+01	nc	2.92E+01	NA	3.00E+04	NA	T	3.00E+04
4-chlorophenyl-phenylether	7005-72-3	NA		NA		NA	NA	NA	NA		NA
diethylphthalate	84-66-2	2.92E+03	nc	2.92E+03	nc	2.92E+03	NA	1.50E+04	NA	T	1.50E+04
4-nitroaniline	100-01-6	NA		NA		NA	NA	9.00E+03	NA	T	9.00E+03
4,6-dinitro-2-methylphenol	534-52-1	NA		3.65E-01	nc	3.65E-01	NA	5.00E+02	NA	T	5.00E+02
n-nitrosodiphenylamine(1)	86-30-6	1.37E+00	c	1.28E+00	c	1.37E+00	NA	NA	NA		NA
4-bromophenyl-phenylether	101-55-3	NA		NA		NA	NA	7.50E+01	NA	T	7.50E+01
hexachlorobenzene	118-74-1	4.18E-03	c	3.91E-03	c	4.18E-03	NA	1.50E+03	NA	T	1.50E+03
pentachlorophenol	87-86-5	5.60E-02	c	5.22E-02	c	5.60E-02	NA	1.50E+04	NA	T	1.50E+04
di-n-butylphthalate	84-74-2	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	5.00E+05	NA	T	5.00E+05
butylbenzylphthalate	85-68-7	7.30E+02	nc	7.30E+02	nc	7.30E+02	NA	1.00E+04	NA	T	1.00E+04
bis(2-ethylhexyl)phthalate	117-81-7	4.80E-01	c	4.47E-01	c	4.80E-01	NA	1.50E+05	NA	T	1.50E+05
di-n-octylphthalate	117-84-0	7.30E+01	nc	7.30E+01	nc	7.30E+01					
PAHs											
acenaphthylene	208-96-8	NA		NA		NA	NA	2.00E+02	NA	T	2.00E+02
acenaphthene	83-32-9	2.19E+02	nc	2.19E+02	nc	2.19E+02	NA	1.25E+03	NA	T	1.25E+03
fluorene	86-73-7	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	7.50E+04	NA	T	7.50E+04
phenanthrene	85-01-8	NA		NA		NA	NA	2.00E+03	NA	T	2.00E+03
anthracene	120-12-7	1.10E+03	nc	1.10E+03	nc	1.10E+03	NA	6.00E+03	NA	T	6.00E+03
fluoranthene	206-44-0	1.46E+02	nc	1.46E+02	nc	1.46E+02	NA	3.00E+01	NA	T	3.00E+01
pyrene	129-00-0	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	1.50E+04	NA	T	1.50E+04
benzo(a)anthracene	56-55-3	2.17E-02	c	8.58E-03	c	2.17E-02	NA	6.00E+02	NA	T	6.00E+02
chrysene	218-01-9	2.17E+00	c	8.58E-01	c	2.17E+00	NA	2.00E+02	NA	T	2.00E+02
benzo(b)fluoranthene	205-99-2	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA	NA		NA
benzo(k)fluoranthene	207-08-9	2.17E-01	c	8.58E-02	c	2.17E-01	NA	NA	NA		NA
benzo(a)pyrene	50-32-8	2.17E-03	c	2.02E-03	c	2.17E-03	NA	7.50E+03	NA	T	7.50E+03
indeno(1,2,3-cd)pyrene	193-39-5	2.17E-02	c	8.58E-03	c	2.17E-02	NA	NA	NA		NA
dibenz(a,h)anthracene	53-70-3	2.17E-03	c	8.58E-04	c	2.17E-03	NA	3.00E+04	NA	T	3.00E+04
benzo(g,h,i)perylene	191-24-2	NA		NA		NA	NA	3.00E+04	NA	T	3.00E+04
Dioxins / Furans											
2378-Tetrachlorodibenzo-p-dioxin	1746-01-6	4.48E-08	c	4.17E-08	c	4.48E-08	NA	3.50E+00	NA	T	3.50E+00
12378-Pentachlorodibenzo-p-dioxin	40321-76-4	NA		NA		NA	NA	2.50E+00	NA	T	2.50E+00
123478-Hexachlorodibenzo-p-dioxin	39227-28-6	NA		NA		NA	NA	NA	NA		NA
123678-Hexachlorodibenzo-p-dioxin	57653-85-7	NA		NA		NA	NA	1.50E+01	NA	T	1.50E+01
123789-Hexachlorodibenzo-p-dioxin	19408-74-3	1.48E-06	c	1.38E-06	c	1.48E-06	NA	NA	NA		NA
1234678-Heptachlorodibenzo-p-dioxin	35822-46-9	NA		NA		NA	NA	NA	NA		NA
Octachlorodibenzo-p-dioxin	3268-87-9	NA		NA		NA	NA	NA	NA		NA
2378-Tetrachlorodibenzo-p-furan	51207-31-9	NA		NA		NA	NA	2.00E+00	NA	T	2.00E+00

Appendix C: Health-based Screening Levels and Acute Toxicity Values										
		For the Chronic Evaluation (HBSL)					For the Acute Evaluation (ATV)			
Compound	CAS #	Region 9 PRG (µg/m³)	Toxicity Endpoint (c or nc)	Region 3 RBC (µg/m³)	Toxicity Endpoint (c or nc)	Health-based Screening Level (µg/m³)	ERPG (µg/m³)	TEEL (µg/m³)	AEGL (µg/m³)	Acute Toxicity Value (µg/m³)
Nitroglycerine	55-63-0	4.80E-01	c	4.47E-01	c	4.80E-01	NA	NA	NA	NA
1,3-Dinitrobenzene	99-65-0	3.65E-01	nc	3.65E-01	nc	3.65E-01	NA	3.00E+03	NA	3.00E+03
2,6-Dinitrotoluene	606-20-2	3.65E+00	nc	3.65E+00	nc	3.65E+00	NA	6.00E+02	NA	6.00E+02
2,4-Dinitrotoluene	121-14-2	7.30E+00	nc	7.30E+00	nc	7.30E+00	NA	6.00E+02	NA	6.00E+02
1,3,5-Trinitrobenzene	99-35-4	1.10E+02	nc	1.10E+02	nc	1.10E+02	NA	3.00E+04	NA	3.00E+04
2,4,6-Trinitrotoluene	118-96-7	2.24E-01	c	2.09E-01	c	2.24E-01	NA	2.50E+04	NA	2.50E+04
RDX	121-82-4	6.11E-02	c	5.69E-02	c	6.11E-02	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	19406-51-0	NA		NA		NA	NA	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	35572-78-2	NA		NA		NA	NA	1.50E+04	NA	1.50E+04
Tetryl	479-45-8	3.65E+01	nc	3.65E+01	nc	3.65E+01	NA	NA	NA	NA
HMX	2691-41-0	1.83E+02	nc	1.83E+02	nc	1.83E+02	NA	NA	NA	NA
Pentaerythritoltetranitrate	78-11-5	NA		NA		NA	NA	5.00E+01	NA	5.00E+01
Dibutyl phthalate	84-74-2	3.65E+02	nc	3.65E+02	nc	3.65E+02	NA	1.50E+04	NA	1.50E+04
Diethyl phthalate	117-81-7	4.80E-01	c	4.47E-01	c	4.80E-01	NA	1.00E+04	NA	1.00E+04
Diphenylamine	122-39-4	9.13E+01	nc	9.13E+01	nc	9.13E+01	NA	3.00E+04	NA	3.00E+04
Footnotes:										
PRG = Preliminary Remediation Goals										
c = cancer										
nc = noncancer										
RBC = Risk-Based Concentrations										
HBSL = Health-Based Screening Level										
(E) ERPG = Emergency Response Planning Guidelines										
(T) TEEL = Temporary Emergency Exposure Limits										
ATV = Acute Toxicity Value										
NA = Not applicable										



**APPENDIX D**

**RISK ASSESSMENT DATA**

**RISK EVALUATION DATA FOR CHARGE M3, FIRED  
FROM THE M199 CANNON, ZONE 3,  
100 METERS DOWNWIND**

Table D-1: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals

155mm propelling charge M3 (zone 3), M199 cannon DODIC: b540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Gases								
NH <sub>3</sub>	2.10E+00	1.04E+02	2.01E-02	no	2.34E+03	1.75E+04	1.34E-01	no
Carbon Dioxide (CO <sub>2</sub> )	3.28E+01	NV		na	1.47E+05	5.40E+07	2.71E-03	no
Carbon Monoxide (CO)	9.20E+01	1.57E+02	5.86E-01	no	1.03E+05	2.30E+05	4.46E-01	no
Nitrogen Oxides (as NO)	6.51E-01	1.00E+02	6.51E-03	no	2.91E+03	2.70E+05	1.08E-02	no
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
Combined Particulate								
TSP	4.25E+00	5.00E+01	8.50E-02	no	4.74E+03	NA		na
PM <sub>10</sub>	3.22E+00	5.00E+01	6.43E-02	no	3.59E+03	NA		na
PM <sub>2.5</sub>	1.26E+00	1.50E+01	8.40E-02	no	1.41E+03	NA		na
Metals								
Antimony	1.14E-10	1.46E+00	7.79E-11	no	5.08E-01	1.50E+03	3.39E-04	no
Arsenic	9.89E-05	4.47E-04	2.21E-01	no	1.03E+00	3.00E+01	3.44E-02	no
Barium	5.94E-03	5.21E-01	1.14E-02	no	2.65E+01	1.50E+03	1.77E-02	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	4.31E-05	1.07E-03	4.04E-02	no	4.50E-01	3.00E+01	1.50E-02	no
Chromium	3.74E-04	1.53E-04	2.45E+00	yes	3.89E+00	1.50E+03	2.60E-03	no
Cobalt	7.57E-05	2.20E+02	3.44E-07	no	3.38E-01	6.00E+01	5.64E-03	no
Copper	6.98E-01	1.46E+02	4.78E-03	no	3.12E+03	3.00E+03	1.04E+00	yes
Lead	1.37E-02	1.50E+00	9.10E-03	no	6.10E+01	1.50E+02	4.07E-01	no
Manganese	2.51E-03	5.11E-02	4.92E-02	no	1.12E+01	3.00E+03	3.74E-03	no
Nickel	1.57E-09	7.30E+01	2.15E-11	no	6.99E+00	3.00E+03	2.33E-03	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	4.38E-11	1.83E+01	2.40E-12	no	1.96E-01	3.00E+02	6.52E-04	no
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	9.99E-08	1.10E+03	9.12E-11	no	4.46E+02	3.00E+04	1.49E-02	no
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
VOCs								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	1.46E-03	5.21E+02	2.80E-06	no	1.63E+00	7.92E+04	2.06E-05	no
Dichloromethane	4.16E-02	4.09E+00	1.02E-02	no	1.08E+02	6.96E+05	1.56E-04	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	1.59E-02	2.49E-01	6.39E-02	no	4.15E+01	1.56E+05	2.66E-04	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	1.08E-03	4.02E+02	2.69E-06	no	1.20E+00	1.88E+05*	6.43E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
<b>Hydrocarbons</b>								
Methane	5.35E-01	NV		na	2.39E+03	3.30E+06	7.24E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

155mm propelling charge M3 (Zone 3), M199 canister DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>SVOCs</b>							
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03	na
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04	na
phenol	1.09E-04	2.19E+03	5.00E-08	no	4.89E-01	3.85E+04	1.27E-05
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03	na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	na
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05	na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04	na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04	na
2-methylphenol	NA	1.83E+02		na	NA	NA	na
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04	na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02	na
4-methylphenol	NA	1.83E+02		na	NA	NA	na
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	na
isophorone	NA	7.08E+00		na	NA	2.83E+04	na
2-nitrophenol	NA	NV		na	NA	NA	na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA	na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA	na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04	na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	na
naphthalene	2.17E-03	3.13E+00	6.93E-04	no	9.68E+00	7.86E+04	1.23E-04
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04	na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04	na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04	na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02	na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA	na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04	na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02	na
2-nitroaniline	NA	2.09E-01		na	NA	NA	na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04	na
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	na



Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
3-nitroaniline	NA	NV		na	NA	9.00E+03	
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03	
dibenzofuran	NA	1.46E+01		na	NA	NA	
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04	
4-chlorophenyl-phenylether	NA	NV		na	NA	NA	
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04	
4-nitroaniline	NA	NV		na	NA	9.00E+03	
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02	
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA	
4-bromophenyl-phenylether	NA	NV		na	NA	NA	
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01	
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03	
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04	
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05	
bis(2-ethylhexyl)phthalate	4.07E-02	4.80E-01	8.48E-02	no	4.24E+02	1.00E+04	4.24E-02
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05	
Footnotes:							
NA = Not applicable							
na = Not available because health-based screening value is not available or not applicable because compound was not detected.							
NV = No value							
C <sub>chronic</sub> = Chronic time-averaged concentration							
HBSL = Chronic health-based screening level							
C <sub>acute</sub> = Acute concentration							
ATV = Acute toxicity value							

Table D-4: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	3.09E-04	NV		na	1.38E+00	2.00E+02	6.89E-03	no
acenaphthene	3.19E-05	2.19E+02	1.46E-07	no	1.43E-01	1.25E+03	1.14E-04	no
fluorene	9.83E-05	1.46E+02	6.74E-07	no	4.39E-01	7.50E+04	5.86E-06	no
phenanthrene	2.86E-04	NV		na	1.28E+00	2.00E+03	6.40E-04	no
anthracene	2.92E-05	1.10E+03	2.66E-08	no	1.30E-01	6.00E+03	2.17E-05	no
fluoranthene	1.93E-04	1.46E+02	1.32E-06	no	8.62E-01	3.00E+01	2.87E-02	no
pyrene	5.50E-04	1.10E+02	5.02E-06	no	2.45E+00	1.50E+04	1.64E-04	no
benzo(a)anthracene	1.21E-05	2.17E-02	5.56E-04	no	1.26E-01	6.00E+02	2.09E-04	no
chrysene	1.20E-05	2.17E+00	5.53E-06	no	1.25E-01	2.00E+02	6.25E-04	no
benzo(b)fluoranthene	1.85E-05	2.17E-02	8.54E-04	no	4.83E-02	NA		na
benzo(k)fluoranthene	2.62E-05	2.17E-01	1.21E-04	no	6.82E-02	NA		na
benzo(a)pyrene	4.19E-05	2.17E-03	1.93E-02	no	4.36E-01	7.50E+03	5.82E-05	no
indeno(1,2,3-cd)pyrene	7.85E-05	2.17E-02	3.62E-03	no	2.04E-01	NA		na
dibenz(a,h)anthracene	2.70E-06	2.17E-03	1.25E-03	no	2.82E-02	3.00E+04	9.39E-07	no
benzo(g,h,i)perylene	4.17E-04	NV		na	1.86E+00	3.00E+04	6.21E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	1.17E-10	4.48E-08	2.61E-03	no	1.22E-06	3.50E+00	3.48E-07	no
12378-Pentachlorodibenzo-p-dioxin	8.34E-10	NV		na	3.73E-06	2.50E+00	1.49E-06	no
123478-Hexachlorodibenzo-p-dioxin	1.25E-09	NV		na	1.39E-06	NA		na
123678-Hexachlorodibenzo-p-dioxin	3.63E-09	NV		na	1.62E-05	1.50E+01	1.08E-06	no
123789-Hexachlorodibenzo-p-dioxin	1.48E-09	1.48E-06	1.00E-03	no	3.86E-06	NA		na
1234678-Heptachlorodibenzo-p-dioxin	7.11E-08	NV		na	7.94E-05	NA		na
Octachlorodibenzo-p-dioxin	4.04E-07	NV		na	4.51E-04	NA		na
2378-Tetrachlorodibenzo-p-furan	9.08E-11	NV		na	4.06E-07	2.00E+00	2.03E-07	no
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	1.07E-10	NV		na	4.80E-07	7.50E-02	6.40E-06	no
123478-Hexachlorodibenzo-p-furan	2.31E-10	NV		na	1.03E-06	7.50E+00	1.37E-07	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	2.53E-09	NV		na	2.83E-06	NA		na
1234789-Heptachlorodibenzo-p-furan	4.19E-10	NV		na	4.68E-07	NA		na
OCDF	7.58E-09	NV		na	8.46E-06	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

Table D-4: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	NA	NV		na	NA	2.00E+03		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-5: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics**  
100 meter location

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Particulate Cyanide and Hydrogen Cyanide (CN)								
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03		na
Hydrogen Cyanide	5.95E-01	3.13E+00	1.90E-01	no	2.66E+03	5.17E+03	5.14E-01	no
Energetics								
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diocetyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-6: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
100 meter location**

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<i>Allphatic: C≤8</i>	<i>Allphatic: C&gt;8</i>	<i>Aromatic: C≤8</i>	<i>Aromatic: C&gt;8</i>
Benzene	NA	NA	3.71E-02	NA
Toluene	NA	NA	1.08E-03	NA
naphthalene	NA	NA	NA	2.17E-03
acenaphthylene	NA	NA	NA	3.09E-04
acenaphthene	NA	NA	NA	3.19E-05
fluorene	NA	NA	NA	9.83E-05
phenanthrene	NA	NA	NA	2.86E-04
anthracene	NA	NA	NA	2.92E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	3.82E-02	2.92E-03
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	9.16E-05	1.40E-05
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3, FIRED  
FROM THE M199 CANNON, ZONE 3,  
200 METERS DOWNWIND**



**Table D-7: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
200 meter location

155mm propelling charge M3 (zone 3), M199 cannon  
DODIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Gases								
NH <sub>3</sub>	8.36E-01	1.04E+02	8.02E-03	no	9.33E+02	1.75E+04	5.33E-02	no
Carbon Dioxide (CO <sub>2</sub> )	1.31E+01	NV		na	5.83E+04	5.40E+07	1.08E-03	no
Carbon Monoxide (CO)	3.66E+01	1.57E+02	2.33E-01	no	4.09E+04	2.30E+05	1.78E-01	no
Nitrogen Oxides (as NO)	2.59E-01	1.00E+02	2.59E-03	no	1.16E+03	2.70E+05	4.29E-03	no
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
Combined Particulate								
TSP	1.69E+00	5.00E+01	3.38E-02	no	1.89E+03	NA		na
PM <sub>10</sub>	1.28E+00	5.00E+01	2.56E-02	no	1.43E+03	NA		na
PM <sub>2.5</sub>	5.02E-01	1.50E+01	3.34E-02	no	5.60E+02	NA		na
Metals								
Antimony	4.53E-11	1.46E+00	3.10E-11	no	2.02E-01	1.50E+03	1.35E-04	no
Arsenic	3.94E-05	4.47E-04	8.82E-02	no	4.10E-01	3.00E+01	1.37E-02	no
Barium	2.36E-03	5.21E-01	4.53E-03	no	1.06E+01	1.50E+03	7.04E-03	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	1.72E-05	1.07E-03	1.61E-02	no	1.79E-01	3.00E+01	5.97E-03	no
Chromium	1.49E-04	1.53E-04	9.74E-01	no	1.55E+00	1.50E+03	1.03E-03	no
Cobalt	3.01E-05	2.20E+02	1.37E-07	no	1.35E-01	6.00E+01	2.24E-03	no
Copper	2.78E-01	1.46E+02	1.90E-03	no	1.24E+03	3.00E+03	4.14E-01	no
Lead	5.44E-03	1.50E+00	3.62E-03	no	2.43E+01	1.50E+02	1.62E-01	no
Manganese	1.00E-03	5.11E-02	1.96E-02	no	4.47E+00	3.00E+03	1.49E-03	no
Nickel	6.23E-10	7.30E+01	8.54E-12	no	2.78E+00	3.00E+03	9.28E-04	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	1.74E-11	1.83E+01	9.56E-13	no	7.79E-02	3.00E+02	2.60E-04	no
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	3.98E-08	1.10E+03	3.63E-11	no	1.78E+02	3.00E+04	5.92E-03	no

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-8: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

200 meter location

155mm propelling charge M3 (zone 3), M199 cannon  
DDIC: D540

Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
VOCs								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	5.82E-04	5.21E+02	1.12E-06	no	6.49E-01	7.92E+04	8.20E-06	no
Dichloromethane	1.66E-02	4.09E+00	4.05E-03	no	4.31E+01	6.96E+05	6.20E-05	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	6.34E-03	2.49E-01	2.55E-02	no	1.65E+01	1.56E+05	1.06E-04	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	4.30E-04	4.02E+02	1.07E-06	no	4.80E-01	1.88E+05	2.56E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

**Table D-8: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
<b>Hydrocarbons</b>								
Methane	2.13E-01	NV		na	9.52E+02	3.30E+06	2.88E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na
Footnotes:								
NA = Not applicable								
na = Not available because health-based screening value is not available or not applicable because compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration								
HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration								
ATV = Acute toxicity value								

**Table D-9: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

200 meter location

155mm propelling charge M3 (zone 3), M199 cannon  
DODIC: D840

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
SVOCs								
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03		na
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04		na
phenol	4.36E-05	2.19E+03	1.99E-08	no	1.95E-01	3.85E+04	5.05E-06	no
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03		na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04		na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04		na
2-methylphenol	NA	1.83E+02		na	NA	NA		na
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04		na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02		na
4-methylphenol	NA	1.83E+02		na	NA	NA		na
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
isophorone	NA	7.08E+00		na	NA	2.83E+04		na
2-nitrophenol	NA	NV		na	NA	NA		na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA		na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA		na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04		na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
naphthalene	8.63E-04	3.13E+00	2.76E-04	no	3.85E+00	7.86E+04	4.90E-05	no
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04		na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04		na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04		na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02		na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA		na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04		na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02		na
2-nitroaniline	NA	2.09E-01		na	NA	NA		na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04		na
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na

**Table D-9: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

200 meter location

155mm propelling charge M3 (zone 3), M199 cannon  
DDIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
3-nitroaniline	NA	NV		na	NA	9.00E+03		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04		na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
bis(2-ethylhexyl)phthalate	1.62E-02	4.80E-01	3.38E-02	no	1.69E+02	1.00E+04	1.69E-02	no
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value



Table D-10: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases  
200 meter location

155mm propelling charge M3 (zone 3), M199 cannon. DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	1.23E-04	NV		na	5.49E-01	2.00E+02	2.74E-03	no
acenaphthene	1.27E-05	2.19E+02	5.81E-08	no	5.68E-02	1.25E+03	4.54E-05	no
fluorene	3.92E-05	1.46E+02	2.68E-07	no	1.75E-01	7.50E+04	2.33E-06	no
phenanthrene	1.14E-04	NV		na	5.09E-01	2.00E+03	2.55E-04	no
anthracene	1.16E-05	1.10E+03	1.06E-08	no	5.18E-02	6.00E+03	8.64E-06	no
fluoranthene	7.69E-05	1.46E+02	5.27E-07	no	3.43E-01	3.00E+01	1.14E-02	no
pyrene	2.19E-04	1.10E+02	2.00E-06	no	9.77E-01	1.50E+04	6.51E-05	no
benzo(a)anthracene	4.80E-06	2.17E-02	2.21E-04	no	5.00E-02	6.00E+02	8.33E-05	no
chrysene	4.78E-06	2.17E+00	2.20E-06	no	4.98E-02	2.00E+02	2.49E-04	no
benzo(b)fluoranthene	7.37E-06	2.17E-02	3.40E-04	no	1.92E-02	NA		na
benzo(k)fluoranthene	1.04E-05	2.17E-01	4.80E-05	no	2.71E-02	NA		na
benzo(a)pyrene	1.67E-05	2.17E-03	7.68E-03	no	1.74E-01	7.50E+03	2.32E-05	no
indeno(1,2,3-cd)pyrene	3.13E-05	2.17E-02	1.44E-03	no	8.14E-02	NA		na
dlbenz(a,h)anthracene	1.08E-06	2.17E-03	4.96E-04	no	1.12E-02	3.00E+04	3.74E-07	no
benzo(g,h,i)perylene	1.66E-04	NV		na	7.41E-01	3.00E+04	2.47E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	4.66E-11	4.48E-08	1.04E-03	no	4.86E-07	3.50E+00	1.39E-07	no
12378-Pentachlorodibenzo-p-dioxin	3.32E-10	NV		na	1.48E-06	2.50E+00	5.93E-07	no
123478-Hexachlorodibenzo-p-dioxin	4.96E-10	NV		na	5.54E-07	NA		na
123678-Hexachlorodibenzo-p-dioxin	1.44E-09	NV		na	6.45E-06	1.50E+01	4.30E-07	no
123789-Hexachlorodibenzo-p-dioxin	5.90E-10	1.48E-06	3.99E-04	no	1.54E-06	NA		na
1234678-Heptachlorodibenzo-p-dioxin	2.83E-08	NV		na	3.16E-05	NA		na
Octachlorodibenzo-p-dioxin	1.61E-07	NV		na	1.80E-04	NA		na
2378-Tetrachlorodibenzo-p-furan	3.62E-11	NV		na	1.61E-07	2.00E+00	8.07E-08	no
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	4.28E-11	NV		na	1.91E-07	7.50E-02	2.55E-06	no
123478-Hexachlorodibenzo-p-furan	9.19E-11	NV		na	4.10E-07	7.50E+00	5.47E-08	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	1.01E-09	NV		na	1.12E-06	NA		na
1234789-Heptachlorodibenzo-p-furan	1.67E-10	NV		na	1.86E-07	NA		na
OCDF	3.02E-09	NV		na	3.37E-06	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na



**Table D-10: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

200 meter location

155mm propelling charge M3 (zone 3), M199 cannon  
DODIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	NA	NV		na	NA	2.00E+03		na

Footnote:  
NA = Not applicable because compound was not detected.  
na = Not available because health-based screening value is not available or not applicable if compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-11: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics

200 meter location

155mm: propelling charge M3 (zone 3), M199 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>Particulate Cyanide and Hydrogen Cyanide (CN)</b>							
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03	
Hydrogen Cyanide	2.37E-01	3.13E+00	7.57E-02	no	1.06E+03	5.17E+03	2.05E-01
<b>Energetics</b>							
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA	na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA	na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04	na
Nitroglycerine	NA	4.80E-01		na	NA	NA	na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03	na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04	na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04	na
RDX	NA	6.11E-02		na	NA	NA	na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA	
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04	
Tetryl	NA	3.65E+01		na	NA	NA	na
HMX	NA	1.83E+02		na	NA	NA	na
Pentaerythritol tetranitrate	NA	NV		na	NA	5.00E+01	na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04	na
Diocyl phthalate	NA	4.80E-01		na	NA	1.00E+04	na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04	na

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-12: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons**  
200 meter location

155mm propelling charge M3 (zone 3), M199 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	Aliphatic:C≤8	Aliphatic:C>8	Aromatic:C≤8	Aromatic:C>8
Benzene	NA	NA	1.48E-02	NA
Toluene	NA	NA	4.30E-04	NA
naphthalene	NA	NA	NA	8.63E-04
acenaphthylene	NA	NA	NA	1.23E-04
acenaphthene	NA	NA	NA	1.27E-05
fluorene	NA	NA	NA	3.92E-05
phenanthrene	NA	NA	NA	1.14E-04
anthracene	NA	NA	NA	1.16E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	1.52E-02	1.16E-03
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	3.65E-05	5.58E-06
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3, FIRED  
FROM THE M284 CANNON, ZONE 3,  
100 METERS DOWNWIND**

**Table D-13: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC; D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>Gases</b>							
NH <sub>3</sub>	2.22E+00	1.04E+02	2.13E-02	no	2.48E+03	1.75E+04	1.42E-01
Carbon Dioxide (CO <sub>2</sub> )	3.81E+01	NV		na	1.70E+05	5.40E+07	3.15E-03
Carbon Monoxide (CO)	9.87E+01	1.57E+02	6.29E-01	no	1.10E+05	2.30E+05	4.79E-01
Nitrogen Oxides (as NO)	7.96E-01	1.00E+02	7.96E-03	no	3.55E+03	2.70E+05	1.32E-02
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06	
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02	
<b>Combined Particulate</b>							
TSP	2.93E+00	5.00E+01	5.86E-02	no	3.27E+03	NA	
PM <sub>10</sub>	2.52E+00	5.00E+01	5.03E-02	no	2.81E+03	NA	
PM <sub>2.5</sub>	1.35E+00	1.50E+01	8.97E-02	no	1.50E+03	NA	
<b>Metals</b>							
Antimony	NA	1.46E+00		na	NA	1.50E+03	
Arsenic	7.83E-05	4.47E-04	1.75E-01	no	8.16E-01	3.00E+01	2.72E-02
Barium	1.83E-03	5.21E-01	3.50E-03	no	8.15E+00	1.50E+03	5.44E-03
Beryllium	NA	8.00E-04		na	NA	5.00E+00	
Cadmium	NA	1.07E-03		na	NA	3.00E+01	
Chromium	1.38E-04	1.53E-04	9.04E-01	no	1.44E+00	1.50E+03	9.59E-04
Cobalt	5.44E-05	2.20E+02	2.47E-07	no	2.43E-01	6.00E+01	4.05E-03
Copper	1.70E-01	1.46E+02	1.16E-03	no	7.58E+02	3.00E+03	2.53E-01
Lead	1.56E-02	1.50E+00	1.04E-02	no	6.96E+01	1.50E+02	4.64E-01
Manganese	1.29E-03	5.11E-02	2.52E-02	no	5.75E+00	3.00E+03	1.92E-03
Nickel	5.59E-10	7.30E+01	7.66E-12	no	2.50E+00	3.00E+03	8.32E-04
Selenium	NA	1.83E+01		na	NA	6.00E+02	
Silver	NA	1.83E+01		na	NA	3.00E+02	
Thallium	NA	2.56E-01		na	NA	3.00E+02	
Zinc	2.97E-08	1.10E+03	2.72E-11	no	1.33E+02	3.00E+04	4.43E-03

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-14: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DDIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>VOCs</b>								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	1.73E-03	5.21E+02	3.33E-06	no	1.94E+00	7.92E+04	2.45E-05	no
Dichloromethane	6.69E-02	4.09E+00	1.64E-02	no	1.74E+02	6.96E+05	2.50E-04	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	1.35E-02	2.49E-01	5.43E-02	no	3.52E+01	1.56E+05	2.26E-04	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	4.18E-04	4.02E+02	1.04E-06	no	4.67E-01	1.88E+05	2.49E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethane	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na



**Table D-14: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIG: D540							
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
Styrene	NA	1.06E+03		na	NA	2.13E+05	na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04	na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05	na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05	na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05	na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05	na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03	na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05	na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	na
<b>Hydrocarbons</b>							
Methane	4.32E-01	NV		na	1.93E+03	3.30E+06	5.85E-04
Ethane	NA	NV		na	NA	NA	na
Ethylene	NA	NV		na	NA	4.60E+05	na
Propane	NA	NV		na	NA	3.78E+06	na
Acetylene	NA	NV		na	NA	NA	na
Isobutane	NA	NV		na	NA	9.52E+05	na
n-Butane	NA	NV		na	NA	5.71E+06	na
Propylene	NA	NV		na	NA	NA	na

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Table D-15: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>SVOCs</b>							
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03	na
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04	na
phenol	8.88E-04	2.19E+03	4.06E-07	no	3.97E+00	3.85E+04	1.03E-04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03	na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	na
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05	na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04	na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04	na
2-methylphenol	NA	1.83E+02		na	NA	NA	na
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04	na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02	na
4-methylphenol	NA	1.83E+02		na	NA	NA	na
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	na
isophorone	NA	7.08E+00		na	NA	2.83E+04	na
2-nitrophenol	NA	NV		na	NA	NA	na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA	na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA	na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04	na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	na
naphthalene	2.40E-03	3.13E+00	7.68E-04	no	1.07E+01	7.86E+04	1.36E-04
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04	na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04	na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04	na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02	na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA	na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04	na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02	na
2-nitroaniline	NA	2.09E-01		na	NA	NA	na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04	na
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	na

Table D-15: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
3-nitroaniline	NA	NV		na	NA	9.00E+03	na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03	na
dlbenzofuran	NA	1.46E+01		na	NA	NA	na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04	na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA	na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04	na
4-nitroaniline	NA	NV		na	NA	9.00E+03	na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02	na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA	na
4-bromophenyl-phenylether	NA	NV		na	NA	NA	na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01	na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03	na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04	na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05	na
bis(2-ethylhexyl)phthalate	1.93E-02	4.80E-01	4.03E-02	no	2.01E+02	1.00E+04	2.01E-02
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05	na
Footnotes:							
NA = Not applicable							
na = Not available because health-based screening value is not available or not applicable because compound was not detected.							
NV = No value							
C <sub>chronic</sub> = Chronic time-averaged concentration							
HBSL = Chronic health-based screening level							
C <sub>acute</sub> = Acute concentration							
ATV = Acute toxicity value							

Table D-16: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	3.86E-04	NV		na	1.72E+00	2.00E+02	8.62E-03	no
acenaphthene	8.92E-05	2.19E+02	4.07E-07	no	3.98E-01	1.25E+03	3.19E-04	no
fluorene	1.37E-04	1.46E+02	9.42E-07	no	6.14E-01	7.50E+04	8.19E-06	no
phenanthrene	2.52E-04	NV		na	1.12E+00	2.00E+03	5.62E-04	no
anthracene	3.89E-05	1.10E+03	3.56E-08	no	1.74E-01	6.00E+03	2.90E-05	no
fluoranthene	1.31E-04	1.46E+02	8.98E-07	no	5.86E-01	3.00E+01	1.95E-02	no
pyrene	3.68E-04	1.10E+02	3.36E-06	no	1.64E+00	1.50E+04	1.10E-04	no
benzo(a)anthracene	1.11E-05	2.17E-02	5.12E-04	no	1.16E-01	6.00E+02	1.93E-04	no
chrysene	1.08E-05	2.17E+00	4.97E-06	no	1.12E-01	2.00E+02	5.61E-04	no
benzo(b)fluoranthene	2.41E-05	2.17E-02	1.11E-03	no	6.27E-02	NA		na
benzo(k)fluoranthene	2.02E-05	2.17E-01	9.32E-05	no	5.27E-02	NA		na
benzo(a)pyrene	3.88E-05	2.17E-03	1.79E-02	no	4.05E-01	7.50E+03	5.39E-05	no
indeno(1,2,3-cd)pyrene	6.03E-05	2.17E-02	2.78E-03	no	1.57E-01	NA		na
dibenz(a,h)anthracene	1.49E-06	2.17E-03	6.88E-04	no	1.55E-02	3.00E+04	5.18E-07	no
benzo(g,h,i)perylene	3.34E-04	NV		na	1.49E+00	3.00E+04	4.97E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	2.18E-10	4.48E-08	4.87E-03	no	2.27E-06	3.50E+00	6.49E-07	no
12378-Pentachlorodibenzo-p-dioxin	NA	NV		na	NA	2.50E+00		na
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	4.04E-10	NV		na	1.81E-06	1.50E+01	1.20E-07	no
123789-Hexachlorodibenzo-p-dioxin	6.98E-11	1.48E-06	4.72E-05	no	1.82E-07	NA		na
1234678-Heptachlorodibenzo-p-dioxin	3.68E-09	NV		na	4.10E-06	NA		na
Octachlorodibenzo-p-dioxin	2.90E-08	NV		na	3.24E-05	NA		na
2378-Tetrachlorodibenzo-p-furan	3.28E-10	NV		na	1.47E-06	2.00E+00	7.33E-07	no
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	1.53E-10	NV		na	6.82E-07	7.50E-02	9.09E-06	no
123478-Hexachlorodibenzo-p-furan	2.71E-10	NV		na	1.21E-06	7.50E+00	1.61E-07	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	1.23E-09	NV		na	1.37E-06	NA		na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
OCDF	1.51E-09	NV		na	1.69E-06	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

**Table D-16: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04	
Acetone	NA	3.65E+02		na	NA	2.37E+06	
Acrolein	NA	2.09E-02		na	NA	2.30E+02	
Propionaldehyde	NA	NV		na	NA	7.50E+04	
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03	
Butyraldehyde	NA	NV		na	NA	7.38E+04	
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04	
Isovaleraldehyde	NA	NV		na	NA	NA	
Valeraldehyde	NA	NV		na	NA	NA	
o,m,p-Tolualdehyde	NA	NV		na	NA	NA	
Hexaldehyde	NA	NV		na	NA	NA	
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA	
<b>Acid Gases</b>							
Hydrogen fluoride	NA	NV		na	NA	1.60E+03	
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03	
Hydrogen bromide	NA	NV		na	NA	9.93E+03	
Nitric Acid	NA	NV		na	NA	5.16E+03	
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03	
Sulfuric Acid	1.41E-01	NV		na	1.58E+02	2.00E+03	7.88E-02
Footnote: NA = Not applicable because compound was not detected. na = Not available because health-based screening value is not available or not applicable if compound was not detected. NV = No value C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value							

**Table D-17: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics**  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>Particulate Cyanide and Hydrogen Cyanide (CN)</b>								
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03		na
Hydrogen Cyanide	8.86E-01	3.13E+00	2.83E-01	no	3.96E+03	5.17E+03	7.65E-01	no
<b>Energetics</b>								
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diethyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value



Table D-18: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
100 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<b>Aliphatic: C≤8</b>	<b>Aliphatic: C&gt;8</b>	<b>Aromatic: C≤8</b>	<b>Aromatic: C&gt;8</b>
Benzene	NA	NA	3.16E-02	NA
Toluene	NA	NA	4.18E-04	NA
naphthalene	NA	NA	NA	2.40E-03
acenaphthylene	NA	NA	NA	3.86E-04
acenaphthene	NA	NA	NA	8.92E-05
fluorene	NA	NA	NA	1.37E-04
phenanthrene	NA	NA	NA	2.52E-04
anthracene	NA	NA	NA	3.89E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	3.20E-02	3.30E-03
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	7.66E-05	1.58E-05
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3, FIRED  
FROM THE M284 CANNON, ZONE 3,  
200 METERS DOWNWIND**

**Table D-19: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>Gases</b>							
NH <sub>3</sub>	8.85E-01	1.04E+02	8.49E-03	no	9.88E+02	1.75E+04	5.65E-02
Carbon Dioxide (CO <sub>2</sub> )	1.52E+01	NV		na	6.78E+04	5.40E+07	1.25E-03
Carbon Monoxide (CO)	3.93E+01	1.57E+02	2.50E-01	no	4.39E+04	2.30E+05	1.91E-01
Nitrogen Oxides (as NO)	3.17E-01	1.00E+02	3.17E-03	no	1.41E+03	2.70E+05	5.24E-03
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06	na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02	na
<b>Combined Particulate</b>							
TSP	1.17E+00	5.00E+01	2.33E-02	no	1.30E+03	NA	na
PM <sub>10</sub>	1.00E+00	5.00E+01	2.00E-02	no	1.12E+03	NA	na
PM <sub>2.5</sub>	5.36E-01	1.50E+01	3.57E-02	no	5.98E+02	NA	na
<b>Metals</b>							
Antimony	NA	1.46E+00		na	NA	1.50E+03	na
Arsenic	3.12E-05	4.47E-04	6.98E-02	no	3.25E-01	3.00E+01	1.08E-02
Barium	7.27E-04	5.21E-01	1.39E-03	no	3.25E+00	1.50E+03	2.16E-03
Beryllium	NA	8.00E-04		na	NA	5.00E+00	na
Cadmium	NA	1.07E-03		na	NA	3.00E+01	na
Chromium	5.49E-05	1.53E-04	3.60E-01	no	5.73E-01	1.50E+03	3.82E-04
Cobalt	2.16E-05	2.20E+02	9.84E-08	no	9.67E-02	6.00E+01	1.61E-03
Copper	6.76E-02	1.46E+02	4.63E-04	no	3.02E+02	3.00E+03	1.01E-01
Lead	6.20E-03	1.50E+00	4.14E-03	no	2.77E+01	1.50E+02	1.85E-01
Manganese	5.12E-04	5.11E-02	1.00E-02	no	2.29E+00	3.00E+03	7.63E-04
Nickel	2.23E-10	7.30E+01	3.05E-12	no	9.94E-01	3.00E+03	3.31E-04
Selenium	NA	1.83E+01		na	NA	6.00E+02	na
Silver	NA	1.83E+01		na	NA	3.00E+02	na
Thallium	NA	2.56E-01		na	NA	3.00E+02	na
Zinc	1.18E-08	1.10E+03	1.08E-11	no	5.29E+01	3.00E+04	1.76E-03
Footnote:							
NA = Not applicable because compound was not detected.							
na = Not available because health-based screening value is not available or not applicable if compound was not detected.							
NV = No value							
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level							
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value							

**Table D-20: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
VOCs								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethane	6.91E-04	5.21E+02	1.32E-06	no	7.71E-01	7.92E+04	9.74E-06	no
Dichloromethane	2.66E-02	4.09E+00	6.52E-03	no	6.94E+01	6.96E+05	9.97E-05	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethane	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	5.38E-03	2.49E-01	2.16E-02	no	1.40E+01	1.56E+05	8.99E-05	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethane	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	1.67E-04	4.02E+02	4.15E-07	no	1.86E-01	1.88E+05	9.91E-07	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethane	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

**Table D-20: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
<i>Hydrocarbons</i>								
Methane	1.72E-01	NV		na	7.69E+02	3.30E+06	2.33E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na
<b>Footnotes:</b> NA = Not applicable na = Not available because health-based screening value is not available or not applicable because compound was not detected. NV = No value C <sub>chronic</sub> = Chronic time-averaged concentration HBSL = Chronic health-based screening level C <sub>acute</sub> = Acute concentration ATV = Acute toxicity value								

Table D-21: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
SVOCs								
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03		na
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04		na
phenol	3.54E-04	2.19E+03	1.61E-07	no	1.58E+00	3.85E+04	4.10E-05	no
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03		na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04		na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04		na
2-methylphenol	NA	1.83E+02		na	NA	NA		na
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04		na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02		na
4-methylphenol	NA	1.83E+02		na	NA	NA		na
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
isophorone	NA	7.08E+00		na	NA	2.83E+04		na
2-nitrophenol	NA	NV		na	NA	NA		na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA		na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA		na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04		na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
naphthalene	9.56E-04	3.13E+00	3.06E-04	no	4.27E+00	7.86E+04	5.43E-05	no
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04		na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04		na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04		na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02		na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA		na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04		na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02		na
2-nitroaniline	NA	2.09E-01		na	NA	NA		na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04		na
2,6-dimethyltoluene	NA	3.65E+00		na	NA	6.00E+02		na



**Table D-21: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DDIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
3-nitroaniline	NA	NV		na	NA	9.00E+03	na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03	na
dibenzofuran	NA	1.46E+01		na	NA	NA	na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04	na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA	na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04	na
4-nitroaniline	NA	NV		na	NA	9.00E+03	na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02	na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA	na
4-bromophenyl-phenylether	NA	NV		na	NA	NA	na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01	na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03	na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04	na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05	na
bis(2-ethylhexyl)phthalate	7.70E-03	4.80E-01	1.60E-02	no	8.02E+01	1.00E+04	8.02E-03
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05	na

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

Table D-22: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases  
200 meter location

200 meter location

155mm propelling charge M3 (zone 3), M284 cannon  
DODIG: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	1.54E-04	NV		na	6.87E-01	2.00E+02	3.43E-03	no
acenaphthene	3.55E-05	2.19E+02	1.62E-07	no	1.59E-01	1.25E+03	1.27E-04	no
fluorene	5.47E-05	1.46E+02	3.75E-07	no	2.44E-01	7.50E+04	3.26E-06	no
phenanthrene	1.00E-04	NV		na	4.47E-01	2.00E+03	2.24E-04	no
anthracene	1.55E-05	1.10E+03	1.42E-08	no	6.92E-02	6.00E+03	1.15E-05	no
fluoranthene	5.22E-05	1.46E+02	3.58E-07	no	2.33E-01	3.00E+01	7.77E-03	no
pyrene	1.47E-04	1.10E+02	1.34E-06	no	6.55E-01	1.50E+04	4.37E-05	no
benzo(a)anthracene	4.42E-06	2.17E-02	2.04E-04	no	4.60E-02	6.00E+02	7.67E-05	no
chrysene	4.29E-06	2.17E+00	1.98E-06	no	4.47E-02	2.00E+02	2.23E-04	no
benzo(b)fluoranthene	9.58E-06	2.17E-02	4.42E-04	no	2.50E-02	NA		na
benzo(k)fluoranthene	8.05E-06	2.17E-01	3.71E-05	no	2.10E-02	NA		na
benzo(a)pyrene	1.55E-05	2.17E-03	7.13E-03	no	1.61E-01	7.50E+03	2.15E-05	no
Indeno(1,2,3-cd)pyrene	2.40E-05	2.17E-02	1.11E-03	no	6.25E-02	NA		na
dibenz(a,h)anthracene	5.94E-07	2.17E-03	2.74E-04	no	6.19E-03	3.00E+04	2.06E-07	no
benzo(g,h,i)perylene	1.33E-04	NV		na	5.93E-01	3.00E+04	1.98E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	8.68E-11	4.48E-08	1.94E-03	no	9.05E-07	3.50E+00	2.59E-07	no
12378-Pentachlorodibenzo-p-dioxin	NA	NV		na	NA	2.50E+00		na
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	1.61E-10	NV		na	7.19E-07	1.50E+01	4.79E-08	no
123789-Hexachlorodibenzo-p-dioxin	2.78E-11	1.48E-06	1.88E-05	no	7.24E-08	NA		na
1234678-Heptachlorodibenzo-p-dioxin	1.46E-09	NV		na	1.63E-06	NA		na
Octachlorodibenzo-p-dioxin	1.15E-08	NV		na	1.29E-05	NA		na
2378-Tetrachlorodibenzo-p-furan	1.31E-10	NV		na	5.83E-07	2.00E+00	2.92E-07	no
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	6.08E-11	NV		na	2.71E-07	7.50E-02	3.62E-06	no
123478-Hexachlorodibenzo-p-furan	1.08E-10	NV		na	4.82E-07	7.50E+00	6.43E-08	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	4.90E-10	NV		na	5.47E-07	NA		na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
OCDF	6.01E-10	NV		na	6.71E-07	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

**Table D-22: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon  
BODIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	5.62E-02	NV		na	6.27E+01	2.00E+03	3.14E-02	no

Footnote:  
NA = Not applicable because compound was not detected.  
na = Not available because health-based screening value is not available or not applicable if compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-23: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics  
200 meter location

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>Particulate Cyanide and Hydrogen Cyanide (CN)</b>								
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03		na
Hydrogen Cyanide	3.53E-01	3.13E+00	1.13E-01	no	1.58E+03	5.17E+03	3.05E-01	no
<b>Energetics</b>								
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritol tetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diocyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-24: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
200 meter location**

155mm propelling charge M3 (zone 3), M284 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<b>Aliphatic: C≤8</b>	<b>Aliphatic: C&gt;8</b>	<b>Aromatic: C≤8</b>	<b>Aromatic: C&gt;8</b>
Benzene	NA	NA	1.26E-02	NA
Toluene	NA	NA	1.67E-04	NA
naphthalene	NA	NA	NA	9.56E-04
acenaphthylene	NA	NA	NA	1.54E-04
acenaphthene	NA	NA	NA	3.55E-05
fluorene	NA	NA	NA	5.47E-05
phenanthrene	NA	NA	NA	1.00E-04
anthracene	NA	NA	NA	1.55E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	1.27E-02	1.32E-03
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	3.05E-05	6.31E-06
>1?	no	no	no	no
<b>Footnotes:</b> >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3, FIRED  
FROM THE M199 CANNON, ZONE 5,  
100 METERS DOWNWIND**



**Table D-25: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m³)	Health-Based Screening Level (µg/m³)	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m³)	Acute Toxicity Value (µg/m³)	C <sub>acute</sub> /ATV	> 1?
Gases								
NH <sub>3</sub>	4.47E+00	1.04E+02	4.29E-02	no	4.99E+03	1.75E+04	2.85E-01	no
Carbon Dioxide (CO <sub>2</sub> )	5.75E+01	NV		na	2.57E+05	5.40E+07	4.75E-03	no
Carbon Monoxide (CO)	1.51E+02	1.57E+02	9.63E-01	no	1.69E+05	2.30E+05	7.34E-01	no
Nitrogen Oxides (as NO)	2.09E+00	1.00E+02	2.09E-02	no	9.35E+03	2.70E+05	3.46E-02	no
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
Combined Particulate								
TSP	6.25E+00	5.00E+01	1.25E-01	no	6.98E+03	NA		na
PM <sub>10</sub>	4.47E+00	5.00E+01	8.93E-02	no	4.99E+03	NA		na
PM <sub>2.5</sub>	1.77E+00	1.50E+01	1.18E-01	no	1.97E+03	NA		na
Metals								
Antimony	1.55E-10	1.46E+00	1.06E-10	no	6.94E-01	1.50E+03	4.63E-04	no
Arsenic	1.48E-04	4.47E-04	3.30E-01	no	1.54E+00	3.00E+01	5.13E-02	no
Barium	3.38E-03	5.21E-01	6.49E-03	no	1.51E+01	1.50E+03	1.01E-02	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	5.05E-05	1.07E-03	4.73E-02	no	5.26E-01	3.00E+01	1.75E-02	no
Chromium	3.18E-04	1.53E-04	2.09E+00	yes	3.32E+00	1.50E+03	2.21E-03	no
Cobalt	9.38E-05	2.20E+02	4.27E-07	no	4.19E-01	6.00E+01	6.98E-03	no
Copper	8.50E-01	1.46E+02	5.82E-03	no	3.79E+03	3.00E+03	1.26E+00	yes
Lead	1.70E-02	1.50E+00	1.13E-02	no	7.58E+01	1.50E+02	5.05E-01	no
Manganese	4.17E-03	5.11E-02	8.17E-02	no	1.86E+01	3.00E+03	6.21E-03	no
Nickel	1.39E-09	7.30E+01	1.90E-11	no	6.20E+00	3.00E+03	2.07E-03	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	5.71E-11	1.83E+01	3.13E-12	no	2.55E-01	3.00E+02	8.50E-04	no
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	1.34E-07	1.10E+03	1.22E-10	no	5.96E+02	3.00E+04	1.99E-02	no

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-26: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>VOCs</b>								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	1.39E-03	5.21E+02	2.67E-06	no	1.56E+00	7.92E+04	1.97E-05	no
Dichloromethane	3.51E-02	4.09E+00	8.58E-03	no	9.14E+01	6.96E+05	1.31E-04	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	1.77E-02	2.49E-01	7.11E-02	no	4.61E+01	1.56E+05	2.96E-04	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	1.15E-03	4.02E+02	2.85E-06	no	1.28E+00	1.88E+05	6.82E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

**Table D-26: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
Hydrocarbons								
Methane	9.69E-01	NV		na	4.33E+03	3.30E+06	1.31E-03	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Table D-27: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>SVOCs</b>							
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03	
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04	
phenol	1.75E-03	2.19E+03	8.01E-07	no	7.84E+00	3.85E+04	2.04E-04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03	
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05	
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04	
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04	
2-methylphenol	NA	1.83E+02		na	NA	NA	
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04	
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02	
4-methylphenol	NA	1.83E+02		na	NA	NA	
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	
isophorone	NA	7.08E+00		na	NA	2.83E+04	
2-nitrophenol	NA	NV		na	NA	NA	
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA	
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA	
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04	
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	
naphthalene	1.16E-03	3.13E+00	3.70E-04	no	5.17E+00	7.86E+04	6.58E-05
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04	
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04	
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04	
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02	
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA	
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04	
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02	
2-nitroaniline	NA	2.09E-01		na	NA	NA	
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04	
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	

**Table D-27: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

100 meter location

155mm propelling charge M3 (zone 5), M199 cannon  
DODIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
3-nitroaniline	NA	NV		na	NA	9.00E+03		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04		na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
bis(2-ethylhexyl)phthalate	2.01E-02	4.80E-01	4.18E-02	no	2.09E+02	1.00E+04	2.09E-02	no
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value



**Table D-28: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DOBIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	1.54E-04	NV		na	6.87E-01	2.00E+02	3.44E-03	no
acenaphthene	NA	2.19E+02		na	NA	1.25E+03		na
fluorene	8.23E-05	1.46E+02	5.84E-07	no	3.68E-01	7.50E+04	4.90E-06	no
phenanthrene	2.38E-04	NV		na	1.06E+00	2.00E+03	5.31E-04	no
anthracene	3.11E-05	1.10E+03	2.84E-08	no	1.39E-01	6.00E+03	2.31E-05	no
fluoranthene	1.64E-04	1.46E+02	1.13E-06	no	7.34E-01	3.00E+01	2.45E-02	no
pyrene	5.01E-04	1.10E+02	4.57E-06	no	2.24E+00	1.50E+04	1.49E-04	no
benzo(a)anthracene	1.23E-05	2.17E-02	5.68E-04	no	1.28E-01	6.00E+02	2.14E-04	no
chrysene	1.33E-05	2.17E+00	6.11E-06	no	1.38E-01	2.00E+02	6.91E-04	no
benzo(b)fluoranthene	2.40E-05	2.17E-02	1.11E-03	no	6.24E-02	NA		na
benzo(k)fluoranthene	3.15E-05	2.17E-01	1.45E-04	no	8.20E-02	NA		na
benzo(a)pyrene	4.40E-05	2.17E-03	2.03E-02	no	4.58E-01	7.50E+03	6.11E-05	no
Indeno(1,2,3-cd)pyrene	7.05E-05	2.17E-02	3.25E-03	no	1.84E-01	NA		na
dibenz(a,h)anthracene	2.23E-06	2.17E-03	1.03E-03	no	2.32E-02	3.00E+04	7.73E-07	no
benzo(g,h,i)perylene	3.95E-04	NV		na	1.76E+00	3.00E+04	5.88E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	2.03E-09	4.48E-08	4.52E-02	no	2.11E-05	3.50E+00	6.04E-06	no
12378-Pentachlorodibenzo-p-dioxin	6.59E-10	NV		na	2.94E-06	2.50E+00	1.18E-06	no
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	1.91E-09	NV		na	8.55E-06	1.50E+01	5.70E-07	no
123789-Hexachlorodibenzo-p-dioxin	2.99E-10	1.48E-06	2.02E-04	no	7.79E-07	NA		na
1234678-Heptachlorodibenzo-p-dioxin	1.65E-08	NV		na	1.84E-05	NA		na
Octachlorodibenzo-p-dioxin	9.60E-08	NV		na	1.07E-04	NA		na
2378-Tetrachlorodibenzo-p-furan	2.08E-09	NV		na	9.29E-06	2.00E+00	4.64E-06	no
12378-Pentachlorodibenzo-p-furan	1.95E-09	NV		na	2.18E-06	NA		na
23478-Pentachlorodibenzo-o-furan	9.11E-10	NV		na	4.07E-06	7.50E-02	5.42E-05	no
123478-Hexachlorodibenzo-p-furan	1.54E-09	NV		na	6.86E-06	7.50E+00	9.15E-07	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	6.41E-10	NV		na	2.86E-06	1.50E+00	1.91E-06	no
1234678-Heptachlorodibenzo-p-furan	6.93E-09	NV		na	7.73E-06	NA		na
1234789-Heptachlorodibenzo-p-furan	3.24E-10	NV		na	3.61E-07	NA		na
OCDF	4.36E-09	NV		na	4.87E-06	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na



**Table D-28: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	NA	NV		na	NA	2.00E+03		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Table D-29: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Particulate Cyanide and Hydrogen Cyanide (CN)								
Particulate Cyanide	6.72E-02	7.30E+01	9.21E-04	no	3.00E+02	5.00E+03	6.00E-02	no
Hydrogen Cyanide	9.24E-01	3.13E+00	2.95E-01	no	4.13E+03	5.17E+03	7.98E-01	no
Energetics								
Nitrobenzene	NA	2.09E+00	.	na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diethyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-30: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons**  
100 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<b>Aliphatic: C&lt;=8</b>	<b>Aliphatic: C&gt;8</b>	<b>Aromatic: C&lt;=8</b>	<b>Aromatic: C&gt;8</b>
Benzene	NA	NA	4.13E-02	NA
Toluene	NA	NA	1.15E-03	NA
naphthalene	NA	NA	NA	1.16E-03
acenaphthylene	NA	NA	NA	1.54E-04
acenaphthene	NA	NA	NA	
fluorene	NA	NA	NA	8.23E-05
phenanthrene	NA	NA	NA	2.38E-04
anthracene	NA	NA	NA	3.11E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	4.25E-02	1.66E-03
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	1.02E-04	7.98E-06
>1?	no	no	no	no
<b>Footnotes:</b> >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3, FIRED  
FROM THE M199 CANNON, ZONE 5,  
200 METERS DOWNWIND**

**Table D-31: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Gases								
NH <sub>3</sub>	1.85E+00	1.04E+02	1.77E-02	no	2.07E+03	1.75E+04	1.18E-01	no
Carbon Dioxide (CO <sub>2</sub> )	2.38E+01	NV		na	1.06E+05	5.40E+07	1.97E-03	no
Carbon Monoxide (CO)	6.26E+01	1.57E+02	3.99E-01	no	6.99E+04	2.30E+05	3.04E-01	no
Nitrogen Oxides (as NO)	8.67E-01	1.00E+02	8.67E-03	no	3.87E+03	2.70E+05	1.43E-02	no
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
Combined Particulate								
TSP	2.59E+00	5.00E+01	5.18E-02	no	2.89E+03	NA		na
PM <sub>10</sub>	1.85E+00	5.00E+01	3.70E-02	no	2.06E+03	NA		na
PM <sub>2.5</sub>	7.32E-01	1.50E+01	4.88E-02	no	8.17E+02	NA		na
Metals								
Antimony	6.43E-11	1.46E+00	4.41E-11	no	2.87E-01	1.50E+03	1.92E-04	no
Arsenic	6.11E-05	4.47E-04	1.37E-01	no	6.37E-01	3.00E+01	2.12E-02	no
Barium	1.40E-03	5.21E-01	2.69E-03	no	6.25E+00	1.50E+03	4.17E-03	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	2.09E-05	1.07E-03	1.96E-02	no	2.18E-01	3.00E+01	7.26E-03	no
Chromium	1.32E-04	1.53E-04	8.63E-01	no	1.37E+00	1.50E+03	9.16E-04	no
Cobalt	3.88E-05	2.20E+02	1.77E-07	no	1.73E-01	6.00E+01	2.89E-03	no
Copper	3.52E-01	1.46E+02	2.41E-03	no	1.57E+03	3.00E+03	5.23E-01	no
Lead	7.02E-03	1.50E+00	4.68E-03	no	3.14E+01	1.50E+02	2.09E-01	no
Manganese	1.73E-03	5.11E-02	3.38E-02	no	7.71E+00	3.00E+03	2.57E-03	no
Nickel	5.75E-10	7.30E+01	7.88E-12	no	2.57E+00	3.00E+03	8.56E-04	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	2.36E-11	1.83E+01	1.29E-12	no	1.09E-01	3.00E+02	3.52E-04	no
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	5.53E-08	1.10E+03	5.05E-11	no	2.47E+02	3.00E+04	8.23E-03	no
Footnote: NA = Not applicable because compound was not detected. na = Not available because health-based screening value is not available or not applicable if compound was not detected. NV = No value C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Table D-32: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>VOCs</b>								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	5.77E-04	5.21E+02	1.11E-06	no	6.44E-01	7.92E+04	8.14E-06	no
Dichloromethane	1.45E-02	4.09E+00	3.55E-03	no	3.78E+01	6.96E+05	5.44E-05	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	7.33E-03	2.49E-01	2.94E-02	no	1.91E+01	1.56E+05	1.22E-04	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	4.74E-04	4.02E+02	1.18E-06	no	5.29E-01	1.88E+05	2.82E-06	no
1,2-Dibromomethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na



**Table D-32: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**

200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
<b>Hydrocarbons</b>								
Methane	4.01E-01	NV		na	1.79E+03	3.30E+06	5.43E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na
Footnotes:								
NA = Not applicable								
na = Not available because health-based screening value is not available or not applicable because compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration								
HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration								
ATV = Acute toxicity value								

**Table D-33: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
SVOCs								
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03		na
bis(2-chloroethyl)ether phenol	NA	5.82E-03		na	NA	5.85E+04		na
	7.26E-04	2.19E+03	3.32E-07	no	3.24E+00	3.85E+04	8.43E-05	no
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03		na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04		na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04		na
2-methylphenol	NA	1.83E+02		na	NA	NA		na
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04		na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02		na
4-methylphenol	NA	1.83E+02		na	NA	NA		na
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
isophorone	NA	7.08E+00		na	NA	2.83E+04		na
2-nitrophenol	NA	NV		na	NA	NA		na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA		na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA		na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04		na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
naphthalene	4.80E-04	3.13E+00	1.53E-04	no	2.14E+00	7.86E+04	2.73E-05	no
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04		na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04		na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04		na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02		na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA		na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04		na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02		na
2-nitroaniline	NA	2.09E-01		na	NA	NA		na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04		na
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na

**Table D-33: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
3-nitroaniline	NA	NV		na	NA	9.00E+03		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04		na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
bis(2-ethylhexyl)phthalate	8.31E-03	4.80E-01	1.73E-02	no	8.66E+01	1.00E+04	8.66E-03	no
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value

Table D-34: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	6.37E-05	NV		na	2.84E-01	2.00E+02	1.42E-03	no
acenaphthene	NA	2.19E+02		na	NA	1.25E+03		na
fluorene	3.41E-05	1.46E+02	2.33E-07	no	1.52E-01	7.50E+04	2.03E-06	no
phenanthrene	9.85E-05	NV		na	4.40E-01	2.00E+03	2.20E-04	no
anthracene	1.29E-05	1.10E+03	1.18E-08	no	5.75E-02	6.00E+03	9.58E-06	no
fluoranthene	6.80E-05	1.46E+02	4.66E-07	no	3.04E-01	3.00E+01	1.01E-02	no
pyrene	2.07E-04	1.10E+02	1.89E-06	no	9.26E-01	1.50E+04	6.17E-05	no
benzo(a)anthracene	5.10E-06	2.17E-02	2.35E-04	no	5.32E-02	6.00E+02	8.86E-05	no
chrysene	5.49E-06	2.17E+00	2.53E-06	no	5.72E-02	2.00E+02	2.86E-04	no
benzo(b)fluoranthene	9.92E-06	2.17E-02	4.57E-04	no	2.58E-02	NA		na
benzo(k)fluoranthene	1.30E-05	2.17E-01	6.00E-05	no	3.39E-02	NA		na
benzo(a)pyrene	1.82E-05	2.17E-03	8.39E-03	no	1.90E-01	7.50E+03	2.53E-05	no
indeno(1,2,3-cd)pyrene	2.92E-05	2.17E-02	1.35E-03	no	7.61E-02	NA		na
dibenz(a,h)anthracene	9.21E-07	2.17E-03	4.25E-04	no	9.60E-03	3.00E+04	3.20E-07	no
benzo(g,h,i)perylene	1.64E-04	NV		na	7.30E-01	3.00E+04	2.43E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	8.40E-10	4.48E-08	1.87E-02	no	8.75E-06	3.50E+00	2.50E-06	no
12378-Pentachlorodibenzo-p-dioxin	2.73E-10	NV		na	1.22E-06	2.50E+00	4.87E-07	no
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	7.92E-10	NV		na	3.54E-06	1.50E+01	2.36E-07	no
123789-Hexachlorodibenzo-p-dioxin	1.24E-10	1.48E-06	8.37E-05	no	3.22E-07	NA		na
1234678-Heptachlorodibenzo-p-dioxin	6.83E-09	NV		na	7.63E-06	NA		na
Octachlorodibenzo-p-dioxin	3.97E-08	NV		na	4.44E-05	NA		na
2378-Tetrachlorodibenzo-p-furan	8.61E-10	NV		na	3.85E-06	2.00E+00	1.92E-06	no
12378-Pentachlorodibenzo-p-furan	8.09E-10	NV		na	9.03E-07	NA		na
23478-Pentachlorodibenzo-o-furan	3.77E-10	NV		na	1.68E-06	7.50E-02	2.24E-05	no
123478-Hexachlorodibenzo-p-furan	6.36E-10	NV		na	2.84E-06	7.50E+00	3.79E-07	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	2.66E-10	NV		na	1.19E-06	1.50E+00	7.90E-07	no
1234678-Heptachlorodibenzo-p-furan	2.87E-09	NV		na	3.20E-06	NA		na
1234789-Heptachlorodibenzo-p-furan	1.34E-10	NV		na	1.50E-07	NA		na
OCDF	1.81E-09	NV		na	2.02E-06	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

**Table D-34: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
<b>Acid Gases</b>								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	NA	NV		na	NA	2.00E+03		na
<b>Footnote:</b> NA = Not applicable because compound was not detected. na = Not available because health-based screening value is not available or not applicable if compound was not detected. NV = No value C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

Table D-35: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics  
200 meter location

200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540								
Compound	C <sub>Chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> / ATV	> 1?
Particulate Cyanide and Hydrogen Cyanide (CN)								
Particulate Cyanide	2.78E-02	7.30E+01	3.81E-04	no	1.24E+02	5.00E+03	2.49E-02	no
Hydrogen Cyanide	3.83E-01	3.13E+00	1.22E-01	no	1.71E+03	5.17E+03	3.30E-01	no
Energetics								
Nitrobenzene	NA	2.09E+00	.	na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diocetyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

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Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value



Table D-36: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
200 meter location

155mm propelling charge M3 (zone 5), M199 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<b>Aliphatic: C≤8</b>	<b>Aliphatic: C&gt;8</b>	<b>Aromatic: C≤8</b>	<b>Aromatic: C&gt;8</b>
Benzene	NA	NA	1.71E-02	NA
Toluene	NA	NA	4.74E-04	NA
naphthalene	NA	NA	NA	4.80E-04
acenaphthylene	NA	NA	NA	6.37E-05
acenaphthene	NA	NA	NA	
fluorene	NA	NA	NA	3.41E-05
phenanthrene	NA	NA	NA	9.85E-05
anthracene	NA	NA	NA	1.29E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	1.76E-02	6.89E-04
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	4.21E-05	3.30E-06
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3A1, FIRED  
FROM THE M199 CANNON, ZONE 3,  
100 METERS DOWNWIND**

**Table D-37: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>Gases</b>								
NH <sub>3</sub>	1.29E+00	1.04E+02	1.24E-02	no	1.44E+03	1.75E+04	8.24E-02	no
Carbon Dioxide (CO <sub>2</sub> )	2.22E+01	NV		na	9.89E+04	5.40E+07	1.83E-03	no
Carbon Monoxide (CO)	5.90E+01	1.57E+02	3.76E-01	no	6.58E+04	2.30E+05	2.86E-01	no
Nitrogen Oxides (as NO)	NA	1.00E+02		na	NA	2.70E+05		na
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
<b>Combined Particulate</b>								
TSP	1.89E+00	5.00E+01	3.78E-02	no	2.11E+03	NA		na
PM <sub>10</sub>	1.34E+00	5.00E+01	2.68E-02	no	1.50E+03	NA		na
PM <sub>2.5</sub>	7.26E-01	1.50E+01	4.84E-02	no	8.11E+02	NA		na
<b>Metals</b>								
Antimony	NA	1.46E+00		na	NA	1.50E+03		na
Arsenic	1.83E-05	4.47E-04	4.10E-02	no	1.91E-01	3.00E+01	6.36E-03	no
Barium	9.14E-04	5.21E-01	1.75E-03	no	4.08E+00	1.50E+03	2.72E-03	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	1.37E-05	1.07E-03	1.29E-02	no	1.43E-01	3.00E+01	4.77E-03	no
Chromium	1.09E-04	1.53E-04	7.16E-01	no	1.14E+00	1.50E+03	7.59E-04	no
Cobalt	2.24E-05	2.20E+02	1.02E-07	no	9.99E-02	6.00E+01	1.66E-03	no
Copper	2.49E-01	1.46E+02	1.71E-03	no	1.11E+03	3.00E+03	3.71E-01	no
Lead	7.34E-03	1.50E+00	4.89E-03	no	3.28E+01	1.50E+02	2.19E-01	no
Manganese	8.14E-04	5.11E-02	1.59E-02	no	3.63E+00	3.00E+03	1.21E-03	no
Nickel	4.45E-10	7.30E+01	6.10E-12	no	1.99E+00	3.00E+03	6.63E-04	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	2.00E-11	1.83E+01	1.10E-12	no	8.94E-02	3.00E+02	2.98E-04	no
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	5.35E-08	1.10E+03	4.88E-11	no	2.39E+02	3.00E+04	7.96E-03	no
Footnote: NA = Not applicable because compound was not detected. na = Not available because health-based screening value is not available or not applicable If compound was not detected. NV = No value C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Table D-38: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
100 meter location

155mm. propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>VOCs</b>								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	8.86E-04	5.21E+02	1.70E-06	no	9.90E-01	7.92E+04	1.25E-05	no
Dichloromethane	3.22E-02	4.09E+00	7.88E-03	no	8.39E+01	6.96E+05	1.21E-04	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	9.30E-03	2.49E-01	3.73E-02	no	2.42E+01	1.56E+05	1.55E-04	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	1.06E-03	4.02E+02	2.64E-06	no	1.18E+00	1.88E+05	6.31E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

**Table D-38: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**

100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
<b>Hydrocarbons</b>								
Methane	3.15E-01	NV		na	1.41E+03	3.30E+06	4.27E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na
Footnotes:								
NA = Not applicable								
na = Not available because health-based screening value is not available or not applicable because compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration								
HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration								
ATV = Acute toxicity value								

**Table D-39: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>SVOCs</b>							
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03	
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04	
phenol	5.10E-03	2.19E+03	2.33E-06	no	2.28E+01	3.85E+04	5.92E-04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03	
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05	
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04	
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04	
2-methylphenol	NA	1.83E+02		na	NA	NA	
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04	
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02	
4-methylphenol	NA	1.83E+02		na	NA	NA	
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	
isophorone	NA	7.08E+00		na	NA	2.83E+04	
2-nitrophenol	NA	NV		na	NA	NA	
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA	
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA	
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04	
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	
naphthalene	1.09E-03	3.13E+00	3.50E-04	no	4.88E+00	7.86E+04	6.21E-05
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04	
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04	
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04	
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02	
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA	
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04	
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02	
2-nitroaniline	NA	2.09E-01		na	NA	NA	
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04	
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	



**Table D-39: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
3-nitroaniline	NA	NV		na	NA	9.00E+03		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04		na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
bis(2-ethylhexyl)phthalate	NA	4.80E-01		na	NA	1.00E+04		na
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value

**Table D-40: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	1.80E-04	NV		na	8.04E-01	2.00E+02	4.02E-03	no
acenaphthene	2.03E-05	2.19E+02	9.27E-08	no	9.07E-02	1.25E+03	7.25E-05	no
fluorene	7.06E-05	1.46E+02	4.84E-07	no	3.15E-01	7.50E+04	4.20E-06	no
phenanthrene	1.21E-04	NV		na	5.40E-01	2.00E+03	2.70E-04	no
anthracene	1.49E-05	1.10E+03	1.36E-08	no	6.65E-02	6.00E+03	1.11E-05	no
fluoranthene	6.69E-05	1.46E+02	4.58E-07	no	2.99E-01	3.00E+01	9.96E-03	no
pyrene	1.61E-04	1.10E+02	1.47E-06	no	7.18E-01	1.50E+04	4.79E-05	no
benzo(a)anthracene	3.87E-06	2.17E-02	1.79E-04	no	4.04E-02	6.00E+02	6.73E-05	no
chrysene	4.73E-06	2.17E+00	2.18E-06	no	4.92E-02	2.00E+02	2.46E-04	no
benzo(b)fluoranthene	1.38E-05	2.17E-02	6.35E-04	no	3.59E-02	NA		na
benzo(k)fluoranthene	8.90E-06	2.17E-01	4.10E-05	no	2.32E-02	NA		na
benzo(a)pyrene	1.76E-05	2.17E-03	8.11E-03	no	1.83E-01	7.50E+03	2.45E-05	no
indeno(1,2,3-cd)pyrene	3.14E-05	2.17E-02	1.45E-03	no	8.19E-02	NA		na
dibenz(a,h)anthracene	9.85E-07	2.17E-03	4.54E-04	no	1.03E-02	3.00E+04	3.42E-07	no
benzo(g,h,i)perylene	1.43E-04	NV		na	6.41E-01	3.00E+04	2.14E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	NA	4.48E-08		na	NA	3.50E+00		na
12378-Pentachlorodibenzo-p-dioxin	1.23E-10	NV		na	5.50E-07	2.50E+00	2.20E-07	no
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	3.50E-10	NV		na	1.56E-06	1.50E+01	1.04E-07	no
123789-Hexachlorodibenzo-p-dioxin	1.69E-10	1.48E-06	1.14E-04	no	4.39E-07	NA		na
1234678-Heptachlorodibenzo-p-dioxin	3.50E-09	NV		na	3.90E-06	NA		na
Octachlorodibenzo-p-dioxin	1.37E-08	NV		na	1.53E-05	NA		na
2378-Tetrachlorodibenzo-p-furan	NA	NV		na	NA	2.00E+00		na
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	NA	NV		na	NA	7.50E-02		na
123478-Hexachlorodibenzo-p-furan	6.25E-11	NV		na	2.79E-07	7.50E+00	3.72E-08	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	2.30E-10	NV		na	2.57E-07	NA		na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
OCDF	4.55E-10	NV		na	5.08E-07	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

**Table D-40: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	NA	NV		na	NA	2.00E+03		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

Table D-41: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics

100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>Particulate Cyanide and Hydrogen Cyanide (CN)</b>							
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03	na
Hydrogen Cyanide	1.40E-01	3.13E+00	4.47E-02	no	6.24E+02	5.17E+03	1.21E-01
<b>Energetics</b>							
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA	na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA	na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04	na
Nitroglycerine	NA	4.80E-01		na	NA	NA	na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03	na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04	na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04	na
RDX	NA	6.11E-02		na	NA	NA	na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA	
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04	
Tetryl	NA	3.65E+01		na	NA	NA	na
HMX	NA	1.83E+02		na	NA	NA	na
Pentaerythritoltetranitrate	NA	NV			NA	5.00E+01	na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04	na
Diethyl phthalate	NA	4.80E-01		na	NA	1.00E+04	na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04	na

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-42: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
100 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<i>Aliphatic: C&lt;=8</i>	<i>Aliphatic: C&gt;8</i>	<i>Aromatic: C&lt;=8</i>	<i>Aromatic: C&gt;8</i>
Benzene	NA	NA	2.17E-02	NA
Toluene	NA	NA	1.06E-03	NA
naphthalene	NA	NA	NA	1.09E-03
acenaphthylene	NA	NA	NA	1.80E-04
acenaphthene	NA	NA	NA	2.03E-05
fluorene	NA	NA	NA	7.06E-05
phenanthrene	NA	NA	NA	1.21E-04
anthracene	NA	NA	NA	1.49E-05
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	2.27E-02	1.50E-03
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	5.45E-05	7.19E-06
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3A1, FIRED  
FROM THE M199 CANNON, ZONE 3,  
200 METERS DOWNWIND**



**Table D-43: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DDIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>Gases</b>							
NH <sub>3</sub>	6.19E-01	1.04E+02	5.93E-03	no	6.91E+02	1.75E+04	3.95E-02
Carbon Dioxide (CO <sub>2</sub> )	1.06E+01	NV		na	4.74E+04	5.40E+07	8.77E-04
Carbon Monoxide (CO)	2.82E+01	1.57E+02	1.80E-01	no	3.15E+04	2.30E+05	1.37E-01
Nitrogen Oxides (as NO)	NA	1.00E+02		na	NA	2.70E+05	na
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06	na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02	na
<b>Combined Particulate</b>							
TSP	9.04E-01	5.00E+01	1.81E-02	no	1.01E+03	NA	na
PM <sub>10</sub>	6.42E-01	5.00E+01	1.28E-02	no	7.17E+02	NA	na
PM <sub>2.5</sub>	3.48E-01	1.50E+01	2.32E-02	no	3.88E+02	NA	na
<b>Metals</b>							
Antimony	NA	1.46E+00		na	NA	1.50E+03	na
Arsenic	8.77E-06	4.47E-04	1.96E-02	no	9.13E-02	3.00E+01	3.04E-03
Barium	4.37E-04	5.21E-01	8.39E-04	no	1.95E+00	1.50E+03	1.30E-03
Beryllium	NA	8.00E-04		na	NA	5.00E+00	na
Cadmium	6.57E-06	1.07E-03	6.16E-03	no	6.85E-02	3.00E+01	2.28E-03
Chromium	5.23E-05	1.53E-04	3.43E-01	no	5.45E-01	1.50E+03	3.63E-04
Cobalt	1.07E-05	2.20E+02	4.87E-08	no	4.78E-02	6.00E+01	7.97E-04
Copper	1.19E-01	1.46E+02	8.17E-04	no	5.33E+02	3.00E+03	1.78E-01
Lead	3.51E-03	1.50E+00	2.34E-03	no	1.57E+01	1.50E+02	1.05E-01
Manganese	3.90E-04	5.11E-02	7.62E-03	no	1.74E+00	3.00E+03	5.80E-04
Nickel	2.13E-10	7.30E+01	2.92E-12	no	9.52E-01	3.00E+03	3.17E-04
Selenium	NA	1.83E+01		na	NA	6.00E+02	na
Silver	9.58E-12	1.83E+01	5.25E-13	no	4.28E-02	3.00E+02	1.43E-04
Thallium	NA	2.56E-01		na	NA	3.00E+02	na
Zinc	2.56E-08	1.10E+03	2.34E-11	no	1.14E+02	3.00E+04	3.81E-03

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-44: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon BODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
VOCs								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	4.24E-04	5.21E+02	8.14E-07	no	4.74E-01	7.92E+04	5.98E-06	no
Dichloromethane	1.54E-02	4.09E+00	3.77E-03	no	4.02E+01	6.96E+05	5.77E-05	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	NA	1.04E+03		na	NA	1.94E+06		na
Benzene	4.45E-03	2.49E-01	1.79E-02	no	1.16E+01	1.56E+05	7.43E-05	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	5.07E-04	4.02E+02	1.26E-06	no	5.66E-01	1.88E+05	3.02E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

**Table D-44: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
Hydrocarbons								
Methane	1.51E-01	NV		na	6.74E+02	3.30E+06	2.04E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Table D-45: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV > 1?
<b>SVOCs</b>							
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03	na
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04	na
phenol	2.44E-03	2.19E+03	1.12E-06	no	1.09E+01	3.85E+04	2.83E-04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03	na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	na
1,4-dichlorobenzene	NA	3.08E-01		na	NA	6.61E+05	na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04	na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04	na
2-methylphenol	NA	1.83E+02		na	NA	NA	na
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04	na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02	na
4-methylphenol	NA	1.83E+02		na	NA	NA	na
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	na
isophorone	NA	7.08E+00		na	NA	2.83E+04	na
2-nitrophenol	NA	NV		na	NA	NA	na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA	na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA	na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04	na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	na
naphthalene	5.24E-04	3.13E+00	1.67E-04	no	2.34E+00	7.86E+04	2.98E-05
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04	na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04	na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04	na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02	na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA	na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04	na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02	na
2-nitroaniline	NA	2.09E-01		na	NA	NA	na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04	na
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	na

**Table D-45: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon  
DODIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
3-nitroaniline	NA	NV		na	NA	9.00E+03		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	NA	3.65E+02		na	NA	1.50E+04		na
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
bis(2-ethylhexyl)phthalate	NA	4.80E-01		na	NA	1.00E+04		na
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value



**Table D-46: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DDIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	8.62E-05	NV		na	3.85E-01	2.00E+02	1.92E-03	no
acenaphthene	9.72E-06	2.19E+02	4.44E-08	no	4.34E-02	1.25E+03	3.47E-05	no
fluorene	3.38E-05	1.46E+02	2.31E-07	no	1.51E-01	7.50E+04	2.01E-06	no
phenanthrene	5.79E-05	NV		na	2.59E-01	2.00E+03	1.29E-04	no
anthracene	7.13E-06	1.10E+03	6.51E-09	no	3.18E-02	6.00E+03	5.31E-06	no
fluoranthene	3.20E-05	1.46E+02	2.19E-07	no	1.43E-01	3.00E+01	4.77E-03	no
pyrene	7.70E-05	1.10E+02	7.03E-07	no	3.44E-01	1.50E+04	2.29E-05	no
benzo(a)anthracene	1.85E-06	2.17E-02	8.55E-05	no	1.93E-02	6.00E+02	3.22E-05	no
chrysene	2.26E-06	2.17E+00	1.04E-06	no	2.36E-02	2.00E+02	1.18E-04	no
benzo(b)fluoranthene	6.59E-06	2.17E-02	3.04E-04	no	1.72E-02	NA		na
benzo(k)fluoranthene	4.26E-06	2.17E-01	1.96E-05	no	1.11E-02	NA		na
benzo(a)pyrene	8.42E-06	2.17E-03	3.88E-03	no	8.78E-02	7.50E+03	1.17E-05	no
indeno(1,2,3-cd)pyrene	1.50E-05	2.17E-02	6.94E-04	no	3.92E-02	NA		na
dibenz(a,h)anthracene	4.72E-07	2.17E-03	2.17E-04	no	4.91E-03	3.00E+04	1.64E-07	no
benzo(g,h,i)perylene	6.87E-05	NV		na	3.07E-01	3.00E+04	1.02E-05	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	NA	4.48E-08		na	NA	3.50E+00		na
12378-Pentachlorodibenzo-p-dioxin	5.90E-11	NV		na	2.63E-07	2.50E+00	1.05E-07	no
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	1.68E-10	NV		na	7.48E-07	1.50E+01	4.99E-08	no
123789-Hexachlorodibenzo-p-dioxin	8.07E-11	1.48E-06	5.46E-05	no	2.10E-07	NA		na
1234678-Heptachlorodibenzo-p-dioxin	1.67E-09	NV		na	1.87E-06	NA		na
Octachlorodibenzo-p-dioxin	6.55E-09	NV		na	7.31E-06	NA		na
2378-Tetrachlorodibenzo-p-furan	NA	NV		na	NA	2.00E+00		na
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	NA	NV		na	NA	7.50E-02		na
123478-Hexachlorodibenzo-p-furan	2.99E-11	NV		na	1.34E-07	7.50E+00	1.78E-08	no
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	1.10E-10	NV		na	1.23E-07	NA		na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
OCDF	2.18E-10	NV		na	2.43E-07	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na



**Table D-46: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	NA	NV		na	NA	5.16E+03		na
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	NA	NV		na	NA	2.00E+03		na
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

**Table D-47: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics**  
200 meter location

200 mg/1000 lb of propellant

155mm propelling charge M3A1 (zone 3), M199 cannon  
DODIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<i>Particulate Cyanide and Hydrogen Cyanide (CN)</i>								
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03		na
Hydrogen Cyanide	6.69E-02	3.13E+00	2.14E-02	no	2.99E+02	5.17E+03	5.78E-02	no
<i>Energetics</i>								
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritoltetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diocetyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na

Footnote:  
NA = Not applicable because compound was not detected.  
na = Not available because health-based screening value is not available or not applicable if compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-48: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
200 meter location

155mm propelling charge M3A1 (zone 3), M199 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<i>Aliphatic: C&lt;=8</i>	<i>Aliphatic: C&gt;8</i>	<i>Aromatic: C&lt;=8</i>	<i>Aromatic: C&gt;8</i>
Benzene	NA	NA	1.04E-02	NA
Toluene	NA	NA	5.07E-04	NA
naphthalene	NA	NA	NA	5.24E-04
acenaphthylene	NA	NA	NA	8.62E-05
acenaphthene	NA	NA	NA	9.72E-06
fluorene	NA	NA	NA	3.38E-05
phenanthrene	NA	NA	NA	5.79E-05
anthracene	NA	NA	NA	7.13E-06
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	1.09E-02	7.18E-04
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	2.61E-05	3.44E-06
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3A1, FIRED  
FROM THE M284 CANNON, ZONE 3,  
100 METERS DOWNWIND**

**Table D-49: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Gases								
NH <sub>3</sub>	1.89E+00	1.04E+02	1.81E-02	no	2.11E+03	1.75E+04	1.21E-01	no
Carbon Dioxide (CO <sub>2</sub> )	2.09E+01	NV		na	9.34E+04	5.40E+07	1.73E-03	no
Carbon Monoxide (CO)	5.66E+01	1.57E+02	3.61E-01	no	6.32E+04	2.30E+05	2.75E-01	no
Nitrogen Oxides (as NO)	1.01E+00	1.00E+02	1.01E-02	no	4.51E+03	2.70E+05	1.67E-02	no
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
Combined Particulate								
TSP	2.00E+00	5.00E+01	4.00E-02	no	2.23E+03	NA		na
PM <sub>10</sub>	1.77E+00	5.00E+01	3.55E-02	no	1.98E+03	NA		na
PM <sub>2.5</sub>	9.93E-01	1.50E+01	6.62E-02	no	1.11E+03	NA		na
Metals								
Antimony	NA	1.46E+00		na	NA	1.50E+03		na
Arsenic	2.93E-05	4.47E-04	6.56E-02	no	3.05E-01	3.00E+01	1.02E-02	no
Barium	1.58E-03	5.21E-01	3.03E-03	no	7.07E+00	1.50E+03	4.71E-03	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	NA	1.07E-03		na	NA	3.00E+01		na
Chromium	6.19E-05	1.53E-04	4.06E-01	no	6.46E-01	1.50E+03	4.30E-04	no
Cobalt	2.19E-05	2.20E+02	9.96E-08	no	9.79E-02	6.00E+01	1.63E-03	no
Copper	7.77E-02	1.46E+02	5.32E-04	no	3.47E+02	3.00E+03	1.16E-01	no
Lead	5.58E-03	1.50E+00	3.72E-03	no	2.49E+01	1.50E+02	1.66E-01	no
Manganese	4.79E-04	5.11E-02	9.38E-03	no	2.14E+00	3.00E+03	7.13E-04	no
Nickel	2.24E-10	7.30E+01	3.06E-12	no	9.99E-01	3.00E+03	3.33E-04	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	NA	1.83E+01		na	NA	3.00E+02		na
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	1.47E-08	1.10E+03	1.34E-11	no	6.55E+01	3.00E+04	2.18E-03	no
Footnote:								
NA = Not applicable because compound was not detected.								
na = Not available because health-based screening value is not available or not applicable if compound was not detected.								
NV = No value								
C <sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level								
C <sub>acute</sub> = Acute concentration; ATV = Acute toxicity value								

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable If compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-50: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**

100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon BODIC: D540							
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>VOCs</b>							
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07	
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05	
Dichlorotetrafluoroethane	NA	NV		na	NA	NA	
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04	
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04	
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04	
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06	
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06	
1,1-Dichloroethene	2.31E-04	5.21E+02	4.44E-07	no	2.58E-01	7.92E+04	3.26E-06
Dichloromethane	6.67E-03	4.09E+00	1.63E-03	no	1.74E+01	6.96E+05	2.50E-05
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03	
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06	
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06	
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05	
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03	
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03	
1,1,1-Trichloroethane	1.54E-03	1.04E+03	1.48E-06	no	1.72E+00	1.94E+06	8.85E-07
Benzene	2.22E-03	2.49E-01	8.91E-03	no	5.78E+00	1.56E+05	3.71E-05
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05	
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05	
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05	
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04	
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA	
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05	
Toluene	3.37E-04	4.02E+02	8.40E-07	no	3.77E-01	1.88E+05	2.01E-06
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05	
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05	
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05	
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05	
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05	



**Table D-50: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIG: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
Hydrocarbons								
Methane	7.27E-02	NV		na	3.25E+02	3.30E+06	9.84E-05	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Table D-51: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DDJC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>SVOCs</b>							
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03	
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04	
phenol	8.81E-04	2.19E+03	4.03E-07	no	3.94E+00	3.85E+04	1.02E-04
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03	
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04	
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05	
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05	
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04	
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04	
2-methylphenol	NA	1.83E+02		na	NA	NA	
hexachloroethane	NA	4.80E-01		na	NA	2.90E+04	
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	2.00E+02	
4-methylphenol	NA	1.83E+02		na	NA	NA	
nitrobenzene	NA	2.09E+00		na	NA	1.51E+04	
isophorone	NA	7.08E+00		na	NA	2.83E+04	
2-nitrophenol	NA	NV		na	NA	NA	
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA	
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA	
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04	
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04	
naphthalene	2.98E-04	3.13E+00	9.53E-05	no	1.33E+00	7.86E+04	1.69E-05
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04	
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04	
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04	
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04	
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02	
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA	
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04	
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02	
2-nitroaniline	NA	2.09E-01		na	NA	NA	
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04	
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	

**Table D-51: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
3-nitroaniline	NA	NV		na	NA	9.00E+03		na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03		na
dibenzofuran	NA	1.46E+01		na	NA	NA		na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04		na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA		na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04		na
4-nitroaniline	NA	NV		na	NA	9.00E+03		na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02		na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA		na
4-bromophenyl-phenylether	NA	NV		na	NA	NA		na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01		na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03		na
di-n-butylphthalate	5.57E-04	3.65E+02	1.53E-06	no	2.49E+00	1.50E+04	1.66E-04	no
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05		na
bis(2-ethylhexyl)phthalate	NA	4.80E-01		na	NA	1.00E+04		na
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05		na

Footnotes:  
NA = Not applicable  
na = Not available because health-based screening value is not available or not applicable because compound was not detected.  
NV = No value  
C<sub>chronic</sub> = Chronic time-averaged concentration  
HBSL = Chronic health-based screening level  
C<sub>acute</sub> = Acute concentration  
ATV = Acute toxicity value

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Table D-52: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	4.96E-05	NV		na	2.21E-01	2.00E+02	1.11E-03	no
acenaphthene	NA	2.19E+02		na	NA	1.25E+03		na
fluorene	2.04E-06	1.46E+02	1.39E-08	no	9.09E-03	7.50E+04	1.21E-07	no
phenanthrene	1.50E-05	NV		na	6.71E-02	2.00E+03	3.35E-05	no
anthracene	4.26E-06	1.10E+03	3.89E-09	no	1.90E-02	6.00E+03	3.17E-06	no
fluoranthene	1.47E-05	1.46E+02	1.01E-07	no	6.57E-02	3.00E+01	2.19E-03	no
pyrene	2.93E-05	1.10E+02	2.67E-07	no	1.31E-01	1.50E+04	8.72E-06	no
benzo(a)anthracene	1.12E-06	2.17E-02	5.15E-05	no	1.16E-02	6.00E+02	1.94E-05	no
chrysene	1.12E-06	2.17E+00	5.15E-07	no	1.16E-02	2.00E+02	5.82E-05	no
benzo(b)fluoranthene	2.92E-06	2.17E-02	1.34E-04	no	7.60E-03	NA		na
benzo(k)fluoranthene	1.93E-06	2.17E-01	8.88E-06	no	5.02E-03	NA		na
benzo(a)pyrene	4.43E-06	2.17E-03	2.04E-03	no	4.61E-02	7.50E+03	6.15E-06	no
indeno(1,2,3-cd)pyrene	6.10E-06	2.17E-02	2.81E-04	no	1.59E-02	NA		na
dibenz(a,h)anthracene	2.09E-07	2.17E-03	9.65E-05	no	2.18E-03	3.00E+04	7.27E-08	no
benzo(g,h,i)perylene	2.52E-05	NV		na	1.13E-01	3.00E+04	3.75E-06	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	NA	4.48E-08		na	NA	3.50E+00		na
12378-Pentachlorodibenzo-p-dioxin	NA	NV		na	NA	2.50E+00		na
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	7.13E-11	NV		na	3.18E-07	1.50E+01	2.12E-08	no
123789-Hexachlorodibenzo-p-dioxin	3.47E-11	1.48E-06	2.35E-05	no	9.05E-08	NA		na
1234678-Heptachlorodibenzo-p-dioxin	8.47E-10	NV		na	9.45E-07	NA		na
Octachlorodibenzo-p-dioxin	4.08E-09	NV		na	4.55E-06	NA		na
2378-Tetrachlorodibenzo-p-furan	NA	NV		na	NA	2.00E+00		na
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	NA	NV		na	NA	7.50E-02		na
123478-Hexachlorodibenzo-p-furan	NA	NV		na	NA	7.50E+00		na
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	5.98E-11	NV		na	6.68E-08	NA		na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
OCDF	1.26E-10	NV		na	1.40E-07	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

**Table D-52: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
100 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	1.90E-03	NV		na	2.12E+00	5.16E+03	4.10E-04	no
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	2.80E-02	NV		na	3.12E+01	2.00E+03	1.56E-02	no

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-53: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics**  
100 meter location

**155mm propelling charge M3A1 (zone 3), M284 cannon**  
**BODIC: D540**

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>Particulate Cyanide and Hydrogen Cyanide (CN)</b>								
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03		na
Hydrogen Cyanide	8.53E-02	3.13E+00	2.73E-02	no	3.81E+02	5.17E+03	7.37E-02	no
<b>Energetics</b>								
Nitrobenzene	NA	2.09E+00		na	NA	1.51E+04		na
2-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
3-Nitrotoluene	NA	3.65E+01		na	NA	NA		na
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04		na
Nitroglycerine	NA	4.80E-01		na	NA	NA		na
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03		na
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02		na
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04		na
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04		na
RDX	NA	6.11E-02		na	NA	NA		na
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA		
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04		na
Tetryl	NA	3.65E+01		na	NA	NA		na
HMX	NA	1.83E+02		na	NA	NA		na
Pentaerythritol tetranitrate	NA	NV		na	NA	5.00E+01		na
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04		na
Diethyl phthalate	NA	4.80E-01		na	NA	1.00E+04		na
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04		na

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value



**Table D-54: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
100 meter location**

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	Aliphatic: C≤8	Aliphatic: C>8	Aromatic: C≤8	Aromatic: C>8
Benzene	NA	NA	5.18E-03	NA
Toluene	NA	NA	3.37E-04	NA
naphthalene	NA	NA	NA	2.98E-04
acenaphthylene	NA	NA	NA	4.96E-05
acenaphthene	NA	NA	NA	NA
fluorene	NA	NA	NA	2.04E-06
phenanthrene	NA	NA	NA	1.50E-05
anthracene	NA	NA	NA	4.26E-06
Total (µg/m <sup>3</sup> )	0.00E+00	0.00E+00	5.52E-03	3.69E-04
Derived Health-Based Screening Level	1.92E+04	1.04E+03	4.17E+02	2.09E+02
C <sub>chronic</sub> /HBSL	0.00E+00	0.00E+00	1.32E-05	1.77E-06
>1?	no	no	no	no
Footnotes: >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

**RISK EVALUATION DATA FOR CHARGE M3A1, FIRED  
FROM THE M284 CANNON, ZONE 3,  
200 METERS DOWNWIND**

**Table D-55: Comparison of Air Concentrations With Health-Based Values: Gases, Particulates and Metals**  
200 meter location

**155mm propelling charge M3A1 (zone 3), M284 cannon**  
**DODIC: D540**

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>Gases</b>								
NH <sub>3</sub>	9.05E-01	1.04E+02	8.68E-03	no	1.01E+03	1.75E+04	5.77E-02	no
Carbon Dioxide (CO <sub>2</sub> )	1.00E+01	NV		na	4.47E+04	5.40E+07	8.28E-04	no
Carbon Monoxide (CO)	2.71E+01	1.57E+02	1.73E-01	no	3.03E+04	2.30E+05	1.32E-01	no
Nitrogen Oxides (as NO)	4.83E-01	1.00E+02	4.83E-03	no	2.16E+03	2.70E+05	7.99E-03	no
Methane (CH <sub>4</sub> )	NA	NV		na	NA	3.30E+06		na
Sulfur Dioxide (SO <sub>2</sub> )	NA	8.00E+01		na	NA	7.89E+02		na
<b>Combined Particulate</b>								
TSP	9.58E-01	5.00E+01	1.92E-02	no	1.07E+03	NA		na
PM <sub>10</sub>	8.49E-01	5.00E+01	1.70E-02	no	9.47E+02	NA		na
PM <sub>2.5</sub>	4.75E-01	1.50E+01	3.17E-02	no	5.31E+02	NA		na
<b>Metals</b>								
Antimony	NA	1.46E+00		na	NA	1.50E+03		na
Arsenic	1.40E-05	4.47E-04	3.14E-02	no	1.46E-01	3.00E+01	4.87E-03	no
Barium	7.58E-04	5.21E-01	1.45E-03	no	3.38E+00	1.50E+03	2.26E-03	no
Beryllium	NA	8.00E-04		na	NA	5.00E+00		na
Cadmium	NA	1.07E-03		na	NA	3.00E+01		na
Chromium	2.97E-05	1.53E-04	1.94E-01	no	3.09E-01	1.50E+03	2.06E-04	no
Cobalt	1.05E-05	2.20E+02	4.77E-08	no	4.69E-02	6.00E+01	7.81E-04	no
Copper	3.72E-02	1.46E+02	2.55E-04	no	1.66E+02	3.00E+03	5.53E-02	no
Lead	2.67E-03	1.50E+00	1.78E-03	no	1.19E+01	1.50E+02	7.95E-02	no
Manganese	2.29E-04	5.11E-02	4.49E-03	no	1.02E+00	3.00E+03	3.42E-04	no
Nickel	1.07E-10	7.30E+01	1.47E-12	no	4.78E-01	3.00E+03	1.59E-04	no
Selenium	NA	1.83E+01		na	NA	6.00E+02		na
Silver	NA	1.83E+01		na	NA	3.00E+02		na
Thallium	NA	2.56E-01		na	NA	3.00E+02		na
Zinc	7.02E-09	1.10E+03	6.41E-12	no	3.13E+01	3.00E+04	1.04E-03	no

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

Table D-56: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
<b>VOCs</b>								
Dichlorodifluoromethane	NA	2.09E+02		na	NA	1.48E+07		na
Methyl Chloride	NA	1.07E+00		na	NA	2.06E+05		na
Dichlorotetrafluoroethane	NA	NV		na	NA	NA		na
Vinyl Chloride	NA	2.20E-02		na	NA	1.28E+04		na
1,3-Butadiene	NA	3.74E-03		na	NA	2.20E+04		na
Methyl Bromide	NA	5.21E+00		na	NA	5.82E+04		na
Ethyl Chloride	NA	2.32E+00		na	NA	7.92E+06		na
Trichlorofluoromethane	NA	7.30E+02		na	NA	2.81E+06		na
1,1-Dichloroethene	4.28E-04	5.21E+02	8.22E-07	no	4.78E-01	7.92E+04	6.04E-06	no
Dichloromethane	1.23E-02	4.09E+00	3.02E-03	no	3.22E+01	6.96E+05	4.62E-05	no
3-Chloropropene	NA	1.04E+00		na	NA	9.39E+03		na
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	3.13E+04		na	NA	9.58E+06		na
1,1-Dichloroethane	NA	5.21E+02		na	NA	1.21E+06		na
cis-1,2-Dichloroethene	NA	3.65E+01		na	NA	7.92E+05		na
Trichloromethane	NA	8.35E-02		na	NA	9.76E+03		na
1,2-Dichloroethane	NA	7.39E-02		na	NA	8.08E+03		na
1,1,1-Trichloroethane	2.85E-03	1.04E+03	2.73E-06	no	3.18E+00	1.94E+06	1.64E-06	no
Benzene	4.11E-03	2.49E-01	1.65E-02	no	1.07E+01	1.56E+05	6.86E-05	no
Carbon Tetrachloride	NA	1.28E-01		na	NA	1.28E+05		na
1,2-Dichloropropane	NA	9.89E-02		na	NA	5.08E+05		na
Trichloroethene	NA	1.12E+00		na	NA	5.38E+05		na
cis-1,3-Dichloropropene	NA	5.17E-02		na	NA	1.14E+04		na
trans-1,3-Dichloropropene	NA	5.17E-02		na	NA	NA		na
1,1,2-Trichloroethane	NA	1.20E-01		na	NA	1.64E+05		na
Toluene	6.25E-04	4.02E+02	1.56E-06	no	6.97E-01	1.88E+05	3.72E-06	no
1,2-Dibromoethane	NA	8.73E-03		na	NA	1.54E+05		na
Tetrachloroethene	NA	3.31E+00		na	NA	6.78E+05		na
Chlorobenzene	NA	6.21E+01		na	NA	1.38E+05		na
Ethylbenzene	NA	1.06E+03		na	NA	5.43E+05		na
m&p-Xylene	NA	7.30E+02		na	NA	6.51E+05		na

**Table D-56: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Styrene	NA	1.06E+03		na	NA	2.13E+05		na
1,1,2,2-Tetrachloroethane	NA	3.31E-02		na	NA	2.06E+04		na
o-Xylene	NA	7.30E+02		na	NA	6.51E+05		na
4-Ethyltoluene	NA	NV		na	NA	1.25E+05		na
1,3,5-Trimethylbenzene	NA	6.21E+00		na	NA	3.68E+05		na
1,2,4-Trimethylbenzene	NA	6.21E+00		na	NA	1.80E+05		na
Benzyl Chloride	NA	3.96E-02		na	NA	5.20E+03		na
m-Dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
p-Dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
o-Dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
1,2,4-Trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
Hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
Hydrocarbons								
Methane	1.35E-01	NV		na	6.01E+02	3.30E+06	1.82E-04	no
Ethane	NA	NV		na	NA	NA		na
Ethylene	NA	NV		na	NA	4.60E+05		na
Propane	NA	NV		na	NA	3.78E+06		na
Acetylene	NA	NV		na	NA	NA		na
Isobutane	NA	NV		na	NA	9.52E+05		na
n-Butane	NA	NV		na	NA	5.71E+06		na
Propylene	NA	NV		na	NA	NA		na

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Footnotes:**

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration

ATV = Acute toxicity value

**Table D-57: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon  
DOBIC: D540

Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
SVOCs								
n-nitrosodimethylamine	NA	1.37E-04		na	NA	2.50E+03		na
bis(2-chloroethyl)ether	NA	5.82E-03		na	NA	5.85E+04		na
phenol	1.63E-03	2.19E+03	7.45E-07	no	7.29E+00	3.85E+04	1.89E-04	no
2-chlorophenol	NA	1.83E+01		na	NA	5.25E+03		na
1,3-dichlorobenzene	NA	3.29E+00		na	NA	3.61E+04		na
1,4-dichlorobenzene	NA	3.06E-01		na	NA	6.61E+05		na
1,2-dichlorobenzene	NA	2.09E+02		na	NA	3.01E+05		na
benzyl alcohol	NA	1.10E+03		na	NA	5.53E+04		na
bis(2-chloroisopropyl)ether	NA	1.92E-01		na	NA	6.99E+04		na
2-methylphenol	NA	1.83E+02		na	NA	2.90E+04		na
hexachloroethane	NA	4.80E-01		na	NA	2.00E+02		na
n-nitroso-di-n-propylamine	NA	9.61E-04		na	NA	NA		na
4-methylphenol	NA	1.83E+02		na	NA	1.51E+04		na
nitrobenzene	NA	2.09E+00		na	NA	2.83E+04		na
isophorone	NA	7.08E+00		na	NA	NA		na
2-nitrophenol	NA	NV		na	NA	NA		na
2,4-dimethylphenol	NA	7.30E+01		na	NA	NA		na
bis(2-chloroethoxy)methane	NA	NV		na	NA	NA		na
2,4-dichlorophenol	NA	1.10E+01		na	NA	3.00E+04		na
1,2,4-trichlorobenzene	NA	2.08E+02		na	NA	3.71E+04		na
naphthalene	5.52E-04	3.13E+00	1.77E-04	no	2.47E+00	7.86E+04	3.14E-05	no
4-chloroaniline	NA	1.46E+01		na	NA	3.00E+04		na
hexachlorobutadiene	NA	8.62E-02		na	NA	3.21E+04		na
4-chloro-3-methylphenol	NA	NV		na	NA	2.00E+04		na
2-methylnaphthalene	NA	7.30E+01		na	NA	2.00E+04		na
hexachlorocyclopentadiene	NA	7.30E-02		na	NA	2.23E+02		na
2,4,6-trichlorophenol	NA	1.10E+02		na	NA	NA		na
2,4,5-trichlorophenol	NA	3.65E+02		na	NA	3.00E+04		na
2-chloronaphthalene	NA	2.92E+02		na	NA	6.00E+02		na
2-nitroaniline	NA	2.09E-01		na	NA	NA		na
dimethylphthalate	NA	3.65E+04		na	NA	1.50E+04		na
2,6-dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02		na



**Table D-57: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds**  
200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DOBIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
3-nitroaniline	NA	NV		na	NA	9.00E+03	na
2,4-dinitrophenol	NA	7.30E+00		na	NA	7.50E+03	na
dibenzofuran	NA	1.46E+01		na	NA	NA	na
2,4-dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	na
4-nitrophenol	NA	2.92E+01		na	NA	3.00E+04	na
4-chlorophenyl-phenylether	NA	NV		na	NA	NA	na
diethylphthalate	NA	2.92E+03		na	NA	1.50E+04	na
4-nitroaniline	NA	NV		na	NA	9.00E+03	na
4,6-dinitro-2-methylphenol	NA	3.65E-01		na	NA	5.00E+02	na
n-nitrosodiphenylamine(1)	NA	1.37E+00		na	NA	NA	na
4-bromophenyl-phenylether	NA	NV		na	NA	NA	na
hexachlorobenzene	NA	4.18E-03		na	NA	7.50E+01	na
pentachlorophenol	NA	5.60E-02		na	NA	1.50E+03	na
di-n-butylphthalate	1.03E-03	3.65E+02	2.83E-06	no	4.61E+00	1.50E+04	3.07E-04
butylbenzylphthalate	NA	7.30E+02		na	NA	5.00E+05	na
bis(2-ethylhexyl)phthalate	NA	4.80E-01		na	NA	1.00E+04	na
di-n-octylphthalate	NA	7.30E+01		na	NA	1.50E+05	na
Footnotes:							
NA = Not applicable							
na = Not available because health-based screening value is not available or not applicable because compound was not detected.							
NV = No value							
C <sub>chronic</sub> = Chronic time-averaged concentration							
HBSL = Chronic health-based screening level							
C <sub>acute</sub> = Acute concentration							
ATV = Acute toxicity value							

**Table D-58: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
PAHs								
acenaphthylene	9.18E-05	NV		na	4.10E-01	2.00E+02	2.05E-03	no
acenaphthene	NA	2.19E+02		na	NA	1.25E+03		na
fluorene	3.77E-06	1.46E+02	2.58E-08	no	1.68E-02	7.50E+04	2.24E-07	no
phenanthrene	2.78E-05	NV		na	1.24E-01	2.00E+03	6.21E-05	no
anthracene	7.88E-06	1.10E+03	7.20E-09	no	3.52E-02	6.00E+03	5.87E-06	no
fluoranthene	2.72E-05	1.46E+02	1.86E-07	no	1.22E-01	3.00E+01	4.05E-03	no
pyrene	5.42E-05	1.10E+02	4.95E-07	no	2.42E-01	1.50E+04	1.61E-05	no
benzo(a)anthracene	2.07E-06	2.17E-02	9.54E-05	no	2.16E-02	6.00E+02	3.60E-05	no
chrysene	2.07E-06	2.17E+00	9.54E-07	no	2.16E-02	2.00E+02	1.08E-04	no
benzo(b)fluoranthene	5.40E-06	2.17E-02	2.49E-04	no	1.41E-02	NA		na
benzo(k)fluoranthene	3.57E-06	2.17E-01	1.64E-05	no	9.29E-03	NA		na
benzo(a)pyrene	8.20E-06	2.17E-03	3.78E-03	no	8.54E-02	7.50E+03	1.14E-05	no
indeno(1,2,3-cd)pyrene	1.13E-05	2.17E-02	5.21E-04	no	2.94E-02	NA		na
dibenz(a,h)anthracene	3.87E-07	2.17E-03	1.79E-04	no	4.04E-03	3.00E+04	1.35E-07	no
benzo(g,h,i)perylene	4.67E-05	NV		na	2.08E-01	3.00E+04	6.95E-06	no
Dioxins / Furans								
2378-Tetrachlorodibenzo-p-dioxin	NA	4.48E-08		na	NA	3.50E+00		na
12378-Pentachlorodibenzo-p-dioxin	NA	NV		na	NA	2.50E+00		na
123478-Hexachlorodibenzo-p-dioxin	NA	NV		na	NA	NA		na
123678-Hexachlorodibenzo-p-dioxin	1.32E-10	NV		na	5.90E-07	1.50E+01	3.93E-08	no
123789-Hexachlorodibenzo-p-dioxin	6.43E-11	1.48E-06	4.35E-05	no	1.68E-07	NA		na
1234678-Heptachlorodibenzo-p-dioxin	1.57E-09	NV		na	1.75E-06	NA		na
Octachlorodibenzo-p-dioxin	7.55E-09	NV		na	8.43E-06	NA		na
2378-Tetrachlorodibenzo-p-furan	NA	NV		na	NA	2.00E+00		na
12378-Pentachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
23478-Pentachlorodibenzo-o-furan	NA	NV		na	NA	7.50E-02		na
123478-Hexachlorodibenzo-p-furan	NA	NV		na	NA	7.50E+00		na
123789-Hexachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
234678-Hexachlorodibenzo-p-furan	NA	NV		na	NA	1.50E+00		na
1234678-Heptachlorodibenzo-p-furan	1.11E-10	NV		na	1.24E-07	NA		na
1234789-Heptachlorodibenzo-p-furan	NA	NV		na	NA	NA		na
OCDF	2.33E-10	NV		na	2.60E-07	NA		na
Aldehydes								
Formaldehyde	NA	1.48E-01		na	NA	1.23E+03		na

**Table D-58: Comparison of Air Concentrations With Health-Based Values: PAHs, Dioxins/Furans, Aldehydes, and Acid Gases**  
200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540								
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV	> 1?
Acetaldehyde	NA	8.73E-01		na	NA	1.80E+04		na
Acetone	NA	3.65E+02		na	NA	2.37E+06		na
Acrolein	NA	2.09E-02		na	NA	2.30E+02		na
Propionaldehyde	NA	NV		na	NA	7.50E+04		na
Crotonaldehyde	NA	3.54E-03		na	NA	5.72E+03		na
Butyraldehyde	NA	NV		na	NA	7.38E+04		na
Benzaldehyde	NA	3.65E+02		na	NA	1.50E+04		na
Isovaleraldehyde	NA	NV		na	NA	NA		na
Valeraldehyde	NA	NV		na	NA	NA		na
o,m,p-Tolualdehyde	NA	NV		na	NA	NA		na
Hexaldehyde	NA	NV		na	NA	NA		na
2,5-Dimethylbenzaldehyde	NA	NV		na	NA	NA		na
Acid Gases								
Hydrogen fluoride	NA	NV		na	NA	1.60E+03		na
Hydrogen chloride	NA	2.08E+01		na	NA	4.50E+03		na
Hydrogen bromide	NA	NV		na	NA	9.93E+03		na
Nitric Acid	3.51E-03	NV		na	3.92E+00	5.16E+03	7.60E-04	no
Phosphoric acid	NA	1.04E+01		na	NA	3.00E+03		na
Sulfuric Acid	5.18E-02	NV		na	5.78E+01	2.00E+03	2.89E-02	no

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Footnote:**

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-59: Comparison of Air Concentrations With Health-Based Values: Cyanides and Energetics**  
200 meter location

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540							
Compound	C <sub>chronic</sub> (µg/m <sup>3</sup> )	Health-Based Screening Level (µg/m <sup>3</sup> )	C <sub>chronic</sub> /HBSL	> 1?	C <sub>acute</sub> (µg/m <sup>3</sup> )	Acute Toxicity Value (µg/m <sup>3</sup> )	C <sub>acute</sub> /ATV
<b>Particulate Cyanide and Hydrogen Cyanide (CN)</b>							
Particulate Cyanide	NA	7.30E+01		na	NA	5.00E+03	
Hydrogen Cyanide	1.58E-01	3.13E+00	5.05E-02	no	7.06E+02	5.17E+03	1.37E-01
<b>Energetics</b>							
Nitrobenzene	NA	2.09E+00	.	na	NA	1.51E+04	
2-Nitrotoluene	NA	3.65E+01		na	NA	NA	
3-Nitrotoluene	NA	3.65E+01		na	NA	NA	
4-Nitrotoluene	NA	3.65E+01		na	NA	3.37E+04	
Nitroglycerine	NA	4.80E-01		na	NA	NA	
1,3-Dinitrobenzene	NA	3.65E-01		na	NA	3.00E+03	
2,6-Dinitrotoluene	NA	3.65E+00		na	NA	6.00E+02	
2,4-Dinitrotoluene	NA	7.30E+00		na	NA	6.00E+02	
1,3,5-Trinitrobenzene	NA	1.10E+02		na	NA	3.00E+04	
2,4,6-Trinitrotoluene	NA	2.24E-01		na	NA	2.50E+04	
RDX	NA	6.11E-02		na	NA	NA	
4-Amino-2,6-Dinitrotoluene	NA	NV			NA	NA	
2-Amino-4,6-Dinitrotoluene	NA	NV			NA	1.50E+04	
Tetryl	NA	3.65E+01		na	NA	NA	
HMX	NA	1.83E+02		na	NA	NA	
Pentaerythritol tetranitrate	NA	NV		na	NA	5.00E+01	
Dibutyl phthalate	NA	3.65E+02		na	NA	1.50E+04	
Diethyl phthalate	NA	4.80E-01		na	NA	1.00E+04	
Diphenylamine	NA	9.13E+01		na	NA	3.00E+04	

Footnote:

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C<sub>chronic</sub> = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C<sub>acute</sub> = Acute concentration; ATV = Acute toxicity value

**Table D-60: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons  
200 meter location**

155mm propelling charge M3A1 (zone 3), M284 cannon DODIC: D540				
Compound (a)	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )	C <sub>chronic</sub> (µg/m <sup>3</sup> )
	<i>Aliphatic: C&lt;=8</i>	<i>Aliphatic: C&gt;8</i>	<i>Aromatic: C&lt;=8</i>	<i>Aromatic: C&gt;8</i>
Benzene	NA	NA	9.59E-03	NA
Toluene	NA	NA	6.25E-04	NA
naphthalene	NA	NA	NA	5.52E-04
acenaphthylene	NA	NA	NA	9.18E-05
acenaphthene	NA	NA	NA	NA
fluorene	NA	NA	NA	3.77E-06
phenanthrene	NA	NA	NA	2.78E-05
anthracene	NA	NA	NA	7.88E-06
Total (µg/m <sup>3</sup> )	0.00E+00 1.92E+04 0.00E+00	0.00E+00 1.04E+03 0.00E+00	1.02E-02 4.17E+02 2.45E-05	6.84E-04 2.09E+02 3.28E-06
Derived Health-Based Screening Level				
C <sub>chronic</sub> /HBSL	no	no	no	no
>1?				
<b>Footnotes:</b> >1? = Is the ratio greater than one? NA = Not Applicable because compound was not detected C <sub>chronic</sub> = chronic averaged air Concentration (not adjusted for cancer averaging time of 70 years) HBSL = Health-Based Screening Level				

## **APPENDIX E**

**FACT SHEET SUBMITTED TO THE  
U.S. ARMY ENVIRONMENTAL CENTER**



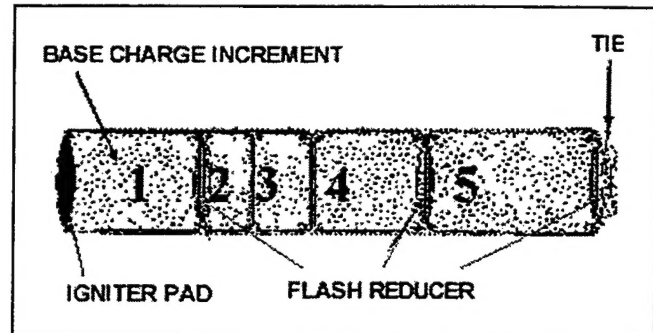
# U.S. Army Environmental Center

## Training Munitions Fact Sheet

### **155-mm Propelling Charge (M3 Series)**

Department of Defense Identification Code: D540

***Breathing air emissions from the 155-mm propelling charge will not impact the health of residents who live as close as 200 meters (656 feet) from the firing location.***



To be fully prepared to protect our country, U.S. soldiers must train with many different weapons and munitions, including the 155-mm propelling charge. This training is important because it helps prepare our soldiers for a variety of combat situations. While the Army recognizes the value of such comprehensive training on our installations, we also work hard to ensure the safety and health of surrounding communities.

### **WILL BREATHING AIR EMISSIONS FROM THE 155-MM PROPELLING CHARGE AFFECT MY HEALTH?**

To answer this question, the U.S. Army tested the air emissions that are released when the 155-mm propelling charge is used. The information gathered during these tests was then analyzed to determine if there would be a potential for health effects from inhalation to residents who live near training areas. Study results, generated using conservative methods, showed that offsite residents breathing air as close as 200 meters (656 feet or about the length of two football fields) from the firing location are safe from these emissions. If offsite residents are located less than 200 meters from the firing locations, a more site-specific evaluation would be necessary. It should be noted that at most locations, training areas are at least 1,000 meters (over half a mile) away from populated areas and the distance to firing locations may be even farther.

### **HOW WAS THE STUDY CONDUCTED?**

To gather data for this study, the M3 series charges were used with two different kinds of howitzer cannons in a test chamber. The air in the chamber was then tested to identify the types and amounts of substances released. About 300 different substances were looked for during this part of the study.

This information was then used in an U.S. Environmental Protection Agency (USEPA) approved air model (a computer program that allows estimation of air concentrations) to determine the amount of each substance to which someone living near a training site might be exposed. Downwind concentrations were estimated based on a typical use scenario for the 155-mm propelling charge during training exercises. Since this study did not look at any one specific training area, the assumptions used in the model would, in most cases, predict higher downwind air concentrations than those expected at an actual training site.

These estimated air concentrations were then compared to screening levels established by the USEPA and other federal agencies. If the air concentrations are less than these screening levels, they are considered safe for the general population, including sensitive people such as the sick, elderly, and children.

### **WHAT ARE THE STUDY LIMITATIONS?**

Many steps were taken to ensure that the results of this study are protective of residents who live near training facilities. However, as with any study, this study has limitations. For example, the study does not consider exposure to other types of munitions that could also be used during the same training event. Due to these limitations, conservative model conditions were used to ensure the protection of public health from breathing air emissions from the 155-mm propelling charge.

### **WHAT EXACTLY IS THE 155-MM PROPELLING CHARGE?**

Propelling charges are a type of explosive that provides the thrust needed to send projectiles into the air. The 155-mm propelling charge is used for firing projectiles from 155-mm howitzers (a kind of cannon). This charge can be classified into two types: M3A1 and M3, or simply, the M3 series. They are also commonly called "green bags". The 155-mm propelling charge consists of five bags of different charge. Each bag is also called an increment. The bags are fastened together with cloth straps sewn to the base of each increment and tied on the top of the fifth increment. Up to five charges can be loaded into the howitzer before a projectile can be fired. The actual number of charges fired with the projectile will depend on the distance to the target and other tactical factors. The M3 and M3A1 charges have a slightly different composition. Charge M3A1 has flash reducer pads that contain either potassium nitrate or potassium sulfate. Both types have an igniter charge which is made up of mostly nitrocellulose or black powder. Nitrocellulose and black powder are commonly used in consumer fireworks.

### **WHERE CAN I GET MORE INFORMATION?**

For more information on the 155-mm propelling charge or other military munitions, please call the Army Environmental Hotline at 1-800-USA-3845, visit our Web site at [www.aec.army.mil](http://www.aec.army.mil), or e-mail [t2hotline@aec.apgea.army.mil](mailto:t2hotline@aec.apgea.army.mil).